

**Rocky Flats Cleanup Agreement, Appendix 3  
RFCA Implementation Guidance Document  
Final**

**A Working Group Product of  
CDPHE  
DOE RFFO  
EPA  
Kaiser-Hill  
RMRS**

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## ACRONYMS

AFP	Approved Funding Program
APO	Analytical Project Office
ALARA	As Low As Reasonably Achievable
ALF	RFCA Action Levels and Standards Framework for Surface Water, Groundwater, and Soils
ANSI/ASQC	American National Standard Institute/American Society for Quality Control
AOC	Area of Concern
APEN	Air Pollution Emission Notices
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
ASD	Analytical Services Division
AST	Analytical Services Toolkit
ASTM	American Society of Testing and Materials
BRA	Baseline Risk Assessment
CAA	Clean Air Act and Amendments
CAD/ROD	Corrective Action Decision/Record of Decision
CAPCD	Colorado Air Pollution Control Division
CAMU	Corrective Action Management Unit
CDPHE	Colorado Department of Public Health and Environment
CDD	Closure Description Document
CEARP	Comprehensive Environmental Analysis and Response Program
C/ED	DOE Office of Communication and Economic Development
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHWA	Colorado Hazardous Waste Act
CMS/FS	Corrective Measure Study/Feasibility Study
COC	Chemical of Concern
COCs	Contaminants of Concern
CPB	Closure Project Baseline
CPS	Closure Project Schedule
CR	Continuing Resolution
CRA	Comprehensive Sitewide Risk Assessment
CWA	Clean Water Act
CWQCC	Colorado Water Quality Control Commission
CWTF	Consolidated Water Treatment Facility
D&D	Decontamination and Decommissioning
DMP	Data Management Plan
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOP	Decommissioning Operations Plan
DPP	Decommissioning Program Plan
DQO	Data Quality Objective
DRC	Dispute Resolution Committee

EDD	Electronic Data Deliverable
EDDIE	Environmental Data Dynamic Information Exchange
EE/CA	Engineering Evaluation/Cost Assessment
EPA	Environmental Protection Agency
ER	Environmental Restoration
ERA	Ecological Risk Assessment
ERAM	Ecological Risk Assessment Methodology
FFCA	Federal Facility Compliance Act
FIP	Field Implementation Plan
FSP	Field Sampling Plan
FY	Fiscal Year
GRA	General Response Actions
HA	Hazard Analysis
HASP	Health and Safety Plan
HHRAM	Human Health Risk Assessment Methodology
HPGe	High Purity Germanium
HQ	DOE Headquarters
HRR	Historical Release Report
HWIR	Hazardous Waste Identification Rule
IAG	Interagency Agreement
IA IM/IRA	Industrial Area Interim Measures/Interim Remedial Action Decision Document
IDM	Investigative Derived Materials
IGD	Implementation Guidance Document
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
INV	Needs Further Investigation
ISB	Integrated Sitewide Baseline
ISEDS	Integrated Sitewide Environmental Data Systems
ISM	Integrated Safety Management
IWMP	Integrated Water Management Plan
LDR	Land Disposal Restrictions
LRA	Lead Regulatory Agency
M2SD	Mean Plus Two Standard Deviations
MAL	Master Activity List
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MCS	Management Control System
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFA	No Action/No Further Action
NLR	No Longer Representative

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NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRMP	Natural Resources Management Policy
OC	Office of Communication
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Act
OU	Operable Unit
PAC	Potential Area of Concern
PAM	Proposed Action Memorandum
PARCC	Precision, Accuracy, Representatives, Completeness, Comparability
PBD	Project Baseline Description
PCB	Polychlorinated Biphenyl
PCOC	Potential Chemicals of Concern
PEG	Program Execution Guidance
POC	Points of Compliance
PP	Proposed Plan
PP/CAD/ROD	Proposed Plan/Corrective Action Decision/Record of Decision
PPE	Personal Protective Equipment
PPRG	Programmatic Preliminary Remediation Goal
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RF CAB	Rocky Flats Citizens Advisory Board
RFEDS	Rocky Flats Environmental Data System
RFETS	Rocky Flats Environmental Technology Site
RF FO	Rocky Flats Field Office
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RFSIPI	Rocky Flats Site-wide Integrated Public Involvement Plan
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RPO	Representative Process Options
RSOP	RFCA Standard Operating Protocols
SAFER	Streamlined Approach for Environmental Restoration
SAP	Sampling and Analysis Plan
SCCB	Site Change Control Board
SEC	Senior Executive Committee
SEDRC	State-EPA Dispute Resolution Committee
SESEC	State-EPA Senior Executive Committee
SNM	Special Nuclear Material
SRA	Support Regulatory Agency

## **1. INTRODUCTION**

### **1.1. SCOPE AND PURPOSE OF ROCKY FLATS CLEANUP AGREEMENT AND IMPLEMENTATION GUIDANCE DOCUMENT**

The Rocky Flats Cleanup Agreement (RFCA) describes the regulatory framework for performing Environmental Restoration (ER) and decommissioning activities at the Rocky Flats Environmental Technology Site (RFETS or site, Site is considered the Comprehensive Environmental Response Compensation and Liability Act [CERCLA] definition as described in RFCA ¶25 b) and b)) RFCA replaces the 1991 Interagency Agreement (IAG) (DOE, 1991) RFCA parties are the Department of Energy (DOE) (the DOE Rocky Flats Field Office is herein denoted as DOE RFFO and DOE Headquarters is denoted as DOE HQ), the Environmental Protection Agency Region VIII (EPA), and the Colorado Department of Public Health and Environment (CDPHE) The RFCA requires the preparation of an Implementation Guidance Document (IGD) (See RFCA¶78) The IGD is a tool that the RFCA parties use to guide the planning, decision making, and implementation of ER and decommissioning at the RFETS The IGD is updated periodically as the site closure progresses to address modifications or changes to the RFCA process

Consistent with RFCA ¶25aj, the IGD contains information on

- Technical approach
- Content of specific decision documents
- Implementation of accelerated actions and decommissioning
- Risk assessment

The intended purposes of the IGD are to

- Provide a "roadmap" for project managers
- Promote the understanding and compliance of non-RFCA authorities
- Standardize and expedite the planning and execution of work
- Provide additional interpretation/clarification of RFCA
- Illustrate the procedures for work prioritization and budgeting

Project management must address a variety of RFCA topics during the planning and execution of work The IGD organizes RFCA subject matter in a manner that highlights relevant language that may be widely distributed throughout RFCA text In this way, the IGD is a roadmap to relevant RFCA language that must be incorporated into the closure process

While RFCA is a broad regulatory agreement that will be the primary authority for decommissioning and ER, other independent regulatory authorities must also be considered and addressed As such, an additional purpose of the IGD is to identify regulatory authorities

external to RFCA, to promote their consideration, and to ensure that these external authorities are addressed

The IGD provides sample schedules, sample tables of contents, and other discussion materials to standardize work planning and execution. Although the IGD is not enforceable, a commitment by the parties to accomplish work within the schedules provided will make parties accountable and expedite work. In addition, without a clear commitment from the parties to honor the scheduling developed during project scoping, it will be difficult to establish meaningful budgets that optimize funding.

Many complex technical and regulatory issues are within the scope of RFCA. It is impossible to craft a legal agreement that will, without interpretation, provide unambiguous language that covers every instance. For this reason, in some circumstances, the IGD will provide clarification to RFCA. The IGD will be particularly useful when procedural nuances have not been explicitly addressed; the IGD consensus process will determine appropriate terms under which the planning and execution of work will be accomplished on a project-specific basis.

Finally, the IGD provides illustrations to aid understanding of the RFETS work prioritization and budgeting process. This multi-step process represents a cooperative risk management exercise that is a vital element in the process to move RFETS through CERCLA, Resource Conservation and Recovery Act (RCRA), and Colorado Hazardous Waste Act (CHWA) process to closure.

## 1.2 ORGANIZATIONAL AND FUNCTIONAL RESPONSIBILITIES

One purpose of RFCA is to integrate CERCLA, RCRA, and CHWA regulatory authorities in a manner that minimizes conflict and expedites action. To that end, a stated objective of the IGD is to employ the same basic approach regardless of whether the work is related to the Industrial Area or the Buffer Zone. (See RFCA ¶78) RFCA also seeks to eliminate unnecessary tasks and duplicate reviews, and to minimize the impact of overlapping statutory authorities. (See RFCA ¶251 and ¶250)

RFCA provides for a Lead Regulatory Agency (LRA) and Support Regulatory Agency (SRA) and prescribes the responsibilities of each. In ¶25a, RFCA defines the LRA as

*that regulatory agency (EPA or CDPHE) which is assigned approval responsibility with respect to actions under this Agreement at a Particular Operable Unit. In addition to its approval role, the LRA will function as the primary communication and correspondence point of contact. The LRA will coordinate technical reviews with the Support Regulatory Agency and consolidate comments, assuring technical and regulatory consistency, and assuring that all regulatory requirements are addressed.*

In ¶25br, RFCA defines the SRA as

*the regulatory agency (EPA or CDPHE) that, for purposes of streamlining implementation of this Agreement, where applicable, shall defer exercise of its regulatory authority at one or more particular OUs (Operable Unit) until the completion of all accelerated actions. The SRA may, however, provide comments to the LRA regarding proposed documents and work.*

In addition, ¶57 of RFCA obligates each party to prepare a written description of its internal organization to be included in the IGD. Each party must designate one or more individuals to perform the functions of project coordinator. This designation may be changed by written notification to the other parties. Each party must also specify one or more points of contact for sending, receiving, and distributing correspondence.

The following sections provide the required description of key functional areas for each RFCA party. Updates will be incorporated on an as-needed basis.

#### **1.2.1. CDPHE Internal Organization and Project Coordinators**

Project Coordinator	Steve Gunderson, (303) 692-3367
Address	Colorado Department Public Health & Environment HMWMD-B2 4300 Cherry Creek Drive South Denver, Colorado 80246-1530
Facsimile	(303) 759-5355
Dispute Resolution Committee	Howard Roitman
Senior Executive Committee	Pat Teegarden

#### **1.2.2. DOE Internal Organization and Project Coordinators**

Project Coordinator	Joe Legare, (303) 966-2282
Address	Rocky Flats Field Office P O Box 928 Golden, Colorado 80402-0928
Facsimile	(303) 966-2995
Dispute Resolution Committee	Joe Legare

Senior Executive Committee

Jessie M Roberson

### **1.2.3. EPA Internal Organization and Project Coordinators**

Project Coordinator

Tim Rehder, (303) 312-6293

Address

999 18th Street, Suite 500  
Denver, Colorado 80202

Facsimile

(303) 312-6067

Dispute Resolution Committee

Max Dodson

Senior Executive Committee

Jack McGraw

### **1.3. ENFORCEABILITY OF RFCA, ATTACHMENTS, APPENDICES, AND IGD**

CHWA permits, Clean Air Act (CAA) permits, National Pollutant Discharge Elimination System (NPDES) permits, and National Environmental Policy Act (NEPA) obligations are outside of RFCA jurisdiction. Regardless, the RFCA does provide mechanisms to integrate these permits with the activities that are subject to RFCA. Specifically, RFCA addresses

- Remedial activities for Individual Hazardous Substance Sites (IHSSs)
- Decommissioning
- Federal Facility Compliance Act (FFCA) compliance for mixed wastes that are not proposed for treatment under the Site Treatment Plan
- Timely completion of milestones
- Closure of underground storage tanks

Within this realm, RFCA consists of a hierarchy of documents with distinct legal enforceability. The preamble to RFCA, the IGD, and the RFCA appendices are not enforceable, while the body of the RFCA and RFCA attachments are enforceable. Consistent with its title, the IGD is a guidance document and is not binding on DOE, CDPHE or EPA, but will be used by the parties for reviewing the adequacy of documents and work. Approved decisions are enforceable.

### **1.4. OVERVIEW OF THE IGD**

The IGD consists of five major sections: (1) Introduction, (2) Project Scoping and Regulatory Integration, (3) Technical Approach and Procedures, (4) Administration, and (5) Public Involvement and Stakeholder Support. The Introduction discusses the scope and purpose of the IGD, the organizational and functional responsibilities of each party, and the enforceability of the IGD. The process for project scoping and the impact of RFCA on

regulatory integration is discussed in Section 2. Section 3 provides technical and procedural detail related to the basic decision tools embodied in RFCA. Additionally, Section 3 presents a discussion of technical aspects of other supporting activities that are necessary components of the combined RCRA Corrective Action/CERCLA process. Examples include risk assessment and Applicable or Relevant and Appropriate Requirement (ARAR) analysis. Section 4 focuses on planning, budgeting, and administration of RFCA record keeping obligations. Processes to promote community involvement are presented in Section 5.

## 2. PROJECT SCOPING AND REGULATORY INTEGRATION

A stated goal of RFCA is to streamline the decision-making process. To accomplish this, RFCA clarifies each party's role in decision making and the legal and regulatory authorities under which the decisions are to be made. RFCA also seeks to create procedures that combine the CERCLA, RCRA, and CHWA requirements so that activities conducted pursuant to the RFCA will satisfy CERCLA, RCRA, and the CHWA statutory requirements without duplicative paperwork.

One mechanism to promote streamlined decision making is project scoping. RFCA defines scoping as

*that period of time, from initial conceptual development of proposed work to DOE's formal request for approval to perform work on an activity, during which DOE consults with the regulators regarding the goals, methods, breadth and desired outcome for such activity (See RFCA ¶25bk)*

### 2.1. OUTLINE FOR PROJECT SCOPING

Project scoping offers an early opportunity for the parties to evaluate and refine technical attributes of the proposed project and to evaluate the regulatory framework, including permitting requirements, within which the project will be conducted. Additionally, project scoping is an opportunity to define how the variety of RFCA requirements and procedures will be implemented. Careful project scoping provides an opportunity to resolve many issues. The overall purpose, process, and factors for project scoping are outlined below.

#### Purpose and Approach

- To speed decision making and cleanup through
  - Early identification of regulatory, physical, and resource barriers
  - A common understanding of goal and path
- To create a better product by using the experience and wisdom of more people

#### Scoping Process

- Identify key parties
- Provide information on proposed activity to each party
- Meet to scope the project

#### Factors in Scoping

- Purpose and goal of project

- Regulatory authorities
  - RFCA
  - Authorities external to RFCA
- Decision-makers
  - EPA
  - CDPHE
  - DOE
  - Others
- Identify critical path events and time lines
- Integration issues
  - Waste management
  - Water management
  - Air
  - NEPA
  - Ecological concerns
  - Deactivation integration with decommissioning
  - Decommissioning integration with ER

## 2.2. SCOPING PROCESS

As the first step in the initiation of a RFCA activity, a scoping meeting will be held between EPA, CDPHE, and DOE RFFO to coordinate the RFCA requirements. Consistent with the RFCA, the LRA designation will be based upon the location at which the activity will be conducted. The purpose of the meeting is to discuss the regulatory requirements and to agree on the scope of the action and the content of the decision document. Consistent with RFCA ¶s 89 and 107, estimated agency review times for Interim Measures/Interim Remedial Actions (IM/IRAs) will be determined. This is not necessary when scoping a Proposed Action Memoranda (PAM) because RFCA is quite specific regarding review duration. Permits that may be needed or that would otherwise be required in the absence of CERCLA §121(e)(1) and the National Contingency Plan (NCP) will be identified during the meeting. At the meeting, the LRA will inform DOE RFFO of the specific performance standards to be addressed within the decision document. Performance standards are generally expected to be based on the RFCA Action Levels and Standards Framework for Surface Water, Groundwater, and Soils (ALF), ARARs, or the Building Disposition guidelines in Attachment 9 of RFCA.

During scoping, one of three permit-related actions may occur

- (1) If the activity is exempt from permitting DOE RFFO will 1) identify any permit that would have been required, 2) identify the standards, requirements or limitations imposed upon the response action, and 3) propose how the response action will meet the standards, requirements or limitations. (See RFCA ¶17). This process will be identical to and coincide with the identification and resolution of ARARs for the

response action Consistent with RFCA ¶18, EPA and CDPHE will provide their positions on any permit waivers in a timely manner

- (2) If permits are required for off-site activities, DOE RFFO will notify and, upon request, provide CDPHE and EPA with copies of the permit applications (See RFCA ¶20)
- (3) CDPHE will determine the need for permits for any RFCA non-decommissioning activity conducted in the Industrial Area so that appropriate permit application documentation may be submitted with the decision document for concurrent public review and approval (See RFCA ¶103 and ¶104)

### **2.3. IDENTIFICATION OF SCOPE AND AUTHORITIES**

CERCLA, RCRA, and CHWA are the underlying regulatory authorities for RFCA RFCA directly defines the limits of the CERCLA/RCRA/CHWA cleanup authorities and directly facilitates the integration of the CERCLA/RCRA/CHWA cleanup authorities where they may overlap In the process of defining the limits of the CERCLA/RCRA/CHWA cleanup authorities embodied in RFCA, RFCA also serves to directly and indirectly clarify the interface of the CERCLA/RCRA/CHWA cleanup authorities with other regulatory authorities that are external to RFCA

To illustrate this point, the following two lists were prepared The first list outlines the scope of RFCA The second list outlines regulatory authorities that are outside the scope of RFCA but will be integrated with RFCA activities Where RFCA gives CDPHE procedural discretion, an item will appear on both lists and will be designated as "elective "

#### **RFCA Scope**

- Decommissioning
  - Decontamination
  - Demolition
  - Dismantlement
- Environmental Restoration
  - Accelerated actions
  - Remedial action
  - Remediation waste management in Corrective Action Management Unit (CAMU)
  - Risk evaluations
  - ARARs
- Corrective Action Decision/Record of Decision (CAD/ROD)
- Modifications to decision documents
- RCRA closure

- Permitted units (elective)
  - Interim status closure (elective)
  - Final disposition of idle equipment (elective)
- Budget planning – Closure Project Baseline (CPB)
- Administrative Record (AR)
- RFCA Dispute Resolution
- Public involvement

#### **Scope External to RFCA**

- Deactivation
- Non-hazardous radioactive waste management
- RCRA process waste management/Part B Permit
  - Waste storage
  - Treatment to meet land disposal restrictions (LDR)
  - On-site disposal (optional)
- RCRA closure
  - Permitted units (elective)
  - Interim status closure (elective)
  - Final disposition of idle equipment (elective)
- NEPA
- Air permitting and National Emission Standards for Hazardous Air Pollutants (NESHAP)
- NPDES (wastewater) and stormwater permitting
- Ecological concerns
- Natural resource damage assessment
- DOE Orders
- Toxic Substances Control Act (TSCA)

The RFCA scope and authorities are discussed in detail in Section 3.0 and associated appendices. The authorities and scope external to RFCA are discussed in Section 2.6.

#### **2.4. DECISION MAKING UNDER RFCA**

Although the underlying CERCLA and CWA substantive authorities held by EPA and CDPHE remain unchanged by RFCA, the assignment of lead and support roles by RFCA has significant procedural effects on decision making and dispute resolution. One example is the consolidation of air permit review and public comment with the RFCA decision process for an accelerated action.

RFCA combines three administrative structures to accomplish the integration of underlying CERCLA and CWA cleanup authorities. First, RFETS has been divided into the Industrial Area and the Buffer Zone. Second, the RFCA provides for a LRA and a SRA.

The combined effect of these RFCA administrative structures is to assign the lead role to CDPHE in the Industrial Area and the lead role to EPA in the Buffer Zone (See RFCA ¶67). The third administrative structure creates a class of "site-wide" issues. A list of site-wide documents is provided in RFCA ¶119. In contrast to the Industrial Area/Buffer Zone division of authority described above, site-wide documents and activities are subject to joint review and approval by CDPHE and EPA. For example, the Integrated Monitoring Plan (IMP) is a site-wide document that integrates a variety of monitoring obligations imposed under RFCA authorities and under authorities external to RFCA. The IMP summarizes Site-wide monitoring requirements for air, surface water, groundwater, and ecology.

Figure 2-1 is a simplified illustration of RFCA's assignment of lead responsibility (primary oversight) for activities at RFETS. It should be understood that Figure 2-1 includes both activities subject to RFCA authority and activities external to the RFCA, like deactivation, which is overseen by the Defense Nuclear Safety Board (DNFSB). Details of activities involving the DNFSB are provided in Appendix 1 of RFCA.

In addition, the figure has been simplified for clarity and may not accurately depict the relative amount of work (e.g., the amount of remediation in the Industrial Area versus the amount of remediation in the Buffer Zone) or accurately depict every jurisdictional possibility. For instance, only very limited circumstances may exist where EPA will be the lead for decommissioning conducted in the Buffer Zone. Finally, this figure shows that all activities conducted at the site are part of the CPB (formerly called the Integrated Site-wide Baseline), which is discussed in Section 4.1.

## 2.5 AUTHORITIES AND SCOPE EXTERNAL TO RFCA

As noted earlier, a number of regulatory authorities external to RFCA need to be integrated with RFCA activities. It will be necessary to coordinate these external authorities during project scoping and during project implementation if there are any deviations from the planned action location or process on which the initial coordination was based (See Kaiser-Hill Company, LLC [K-H] Directive, "Site Activity Environmental Assessment"). These external authorities can be critical to timely project implementation. To facilitate the coordination, RFETS has created an Environmental Checklist to ensure that each internal and external authority is considered (see Appendix A). Because the RFETS Environmental Checklist is revised periodically, it is necessary to obtain the most recent version from the RFETS NEPA group.

External regulatory authorities that need to be integrated into RFCA Activities are

- Waste Management
- Water (Wastewater, Spills)
- NEPA
- Air
- Ecology

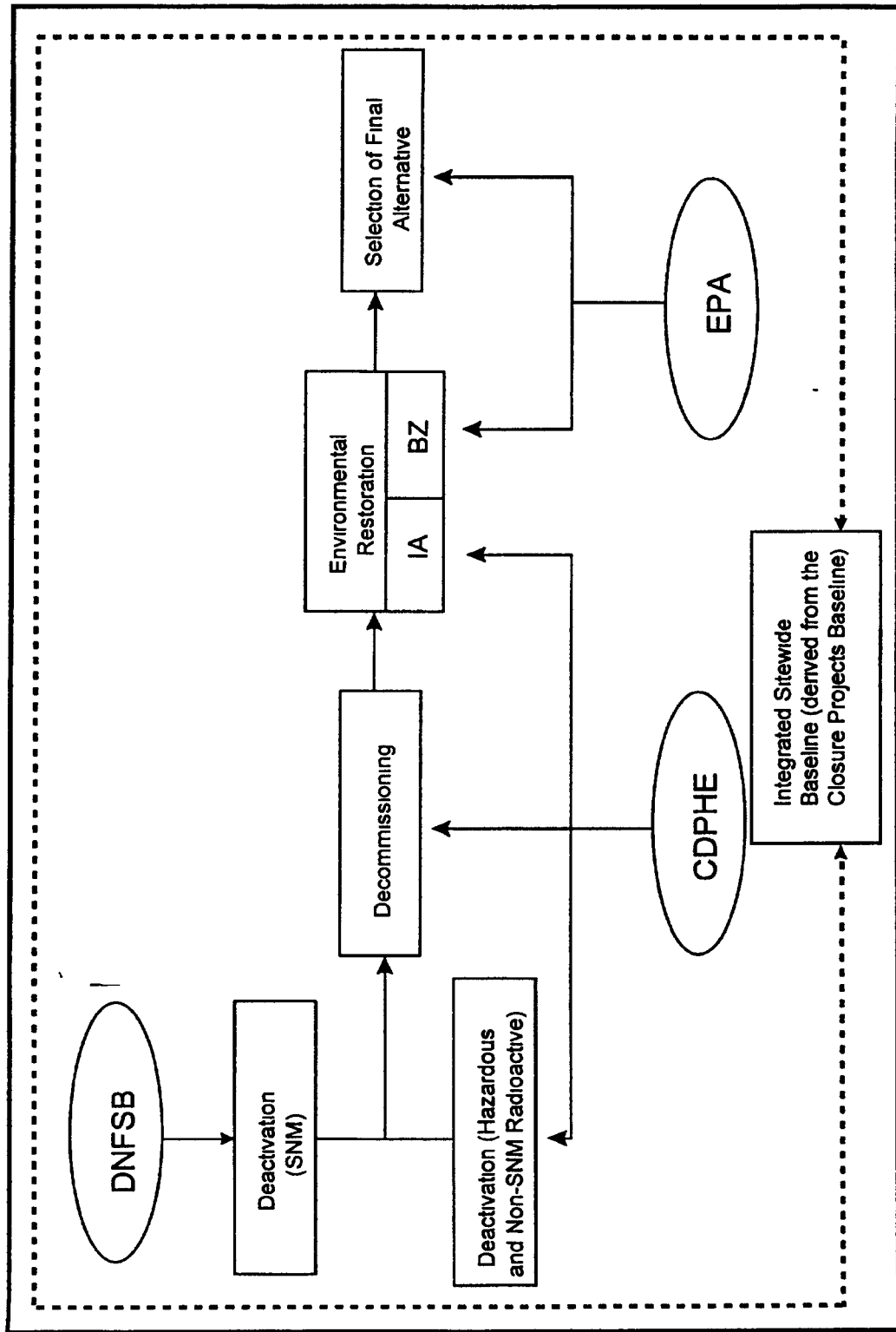


Figure 2-1 Primary Oversight and Facility Disposition Flow

- Health and Safety

Each of these authorities is discussed in the following sections

### **2.5.1. Waste Management**

Waste management activities are subject to requirements external to RFCA that are dependent upon the levels of radioactivity, the types of hazards, and the management strategy employed. As a result, the amount of waste anticipated from the activity must be evaluated so that on-site storage capacity, on-site or off-site treatment capability (as needed), and final off-site disposal options are identified. This evaluation is critical due to limited capacity for on-site storage, limited on-site and off-site treatment capabilities, restrictive waste acceptance criteria at currently licensed/permitted off-site disposal facilities, and the cost of waste management.

#### **Project-Specific Waste Management Strategy**

Two approaches will help complete this evaluation

- (1) Project-specific waste management strategy
- (2) CERCLA Permit waivers

Each are discussed in the following paragraphs

During scoping it is necessary to identify a feasible strategy for long-term waste management and to provide project-specific funding to implement the strategy. This "projectization" approach should minimize the generation of "orphan" wastes with no identified long-term management alternative. The waste management strategy needs to address the following

- Identification and quantification of each waste stream
- Segregation and staging
- Short-term storage
- Treatment
- Sampling and packaging to meet waste acceptance criteria
- If appropriate, an existing or proposed (new) contracting mechanism

This is not to say that long-term storage is not allowed. Instead, it obligates the project to identify and fund presently available long-term storage space or to fund and create new long-term storage space for those wastes where no other feasible management alternative is identified.

### **CERCLA Permit Waivers**

CERCLA permit waivers are available to decommissioning activities, to ER activities in the Buffer Zone, and to limited ER activities in the Industrial Area. These waivers can streamline the approval of additional, protective storage capacity specifically designed to address the level of risk associated with the wastes. The basis for the waivers must be included in a submittal to CDPHE and EPA. See Section 3.5.4 for a complete discussion of permit waivers.

In addition, planning is underway to implement a CAMU for temporary waste storage as a contingency if RFETS can not meet the goals of the Site Closure Project Plan (currently called the 2006 Closure Project Baseline). When completed, the CAMU may accept remediation wastes generated from RFCA decommissioning and ER activities. Process wastes that are also hazardous wastes are not within the definition of remediation wastes and although not eligible for management in the CAMU may be co-located with remediation wastes in accordance with RFCA Appendix B. Similarly, some polychlorinated biphenyl (PCB) wastes (e.g., wastes generated from fluorescent light ballasts) will not be eligible for management in the CAMU. A variety of activities at the site involve disturbing and managing soils. Portions of the soil may be contaminated with hazardous or radiological constituents at varying levels. In many instances, management of the soils will be specifically addressed in a decision document or associated technical memoranda. In other situations (e.g., construction not associated with decommissioning or ER) there will be no RFCA decision document to cover the activity. In these situations, the soil should be managed in accordance with Section 3.12 of the IGD.

### **CERCLA Off-Site Rule**

Wastes generated under RFCA/CERCLA authorities are subject to the CERCLA Off-Site Rule. (See RFCA ¶19 and 40 CFR § 300.440). The CERCLA Off-Site Rule requires regulatory approval of any off-site disposal facility prior to disposing wastes generated under CERCLA authority. The rule avoids having wastes from CERCLA-authorized actions contribute to present or future environmental problems by directing these wastes to management units determined to be environmentally sound and having no significant violations or uncontrolled releases. Verifications of CERCLA Off-Site Rule determinations will be accomplished as part of the Kaiser-Hill Team's Off-Site Waste Management program. If a facility does not have CERCLA approval, DOE RFFO will request approval through EPA. DOE RFFO must verify compliance with the Off-Site Rule prior to waste shipment. In addition, the determination of acceptability must be updated and documented periodically (i.e., every 6 months). EPA will make reasonable efforts to assist DOE RFFO with timely Off-Site Rule determinations.

### **LDR Mixed Wastes**

For LDR mixed wastes, treatment will be covered under the appropriate decision documents and will not be added to the RFETS Site Treatment Plan unless The LDR waste would be managed in treatment systems implemented under the Site Treatment Plan, or they were not provided for in a decision document. The applicability of LDR treatment standards and the achievement of LDR compliance for the mixed wastes to which LDR treatment is applicable must be explicitly addressed in the appropriate decision document.

### **PCB Wastes**

Wastes contaminated with PCBs will be generated by activities external to RFCA. Routinely generated, leaking fluorescent light ballasts that contain PCBs are fully regulated under TSCA and must be stored, inspected and disposed in accordance with the TSCA requirements. All PCB-containing ballasts removed during decommissioning of Type 1 buildings are also subject to TSCA regulation. Building types are described in the Decommissioning Program Plan (DPP) Section 3.2. RFETS also has two PCB-containing transformers in service. These transformers remain fully regulated by TSCA (administratively and substantively) unless and until they become subject to a decommissioning decision document.

If a decision document controlling the decommissioning of a Type 2 or Type 3 building specifically includes one or both of the transformers, management of the transformers must then be accomplished in a manner that attains the substantive attributes of the identified ARARs. Likewise, management of PCB light ballasts must also attain substantive ARARs. Full compliance with both substantive and administrative requirements for off-site PCB management is mandated when the PCB wastes are shipped off-site for treatment, storage, or disposal.

### **2.5.2. Water**

Activities conducted pursuant to RFCA will generate water and wastewater that must be managed and, if necessary, treated at the appropriate facilities. In addition, each project may have to incorporate special considerations for stormwater management, spill controls and countermeasures, and other environmental protection measures.

### **Wastewater Management**

Since 1979, RFETS has held a National Pollutant Discharge Elimination System (NPDES) permit regulating the discharge of treated wastewater into off-site waterways. A renewal of the current permit has been prepared, but has not been issued as of July 20, 1998. Generally, the NPDES permit implements the requirements of the Clean Water Act (CWA) and regulates the discharge of the site's wastewater treatment plant, Building 995, the release of

product water from Building 374, and storm water discharges. In addition to establishing the performance standards for Buildings 995 and 374, and limitations on specific parameters in the discharge, the permit also imposes a number of administrative requirements from employee training to pollution prevention and spill control practices described below. Presently, a range of wastewater treatment capability is available at RFETS, but the continued availability of these wastewater treatment capabilities is subject to change. Pursuant to RFCA, an Integrated Water Management Plan (IWMP) (RFETS, 1997) has been developed as a Site-wide document to evaluate short and long-term wastewater treatment needs (See RFCA ¶119). As a reference source, the IWMP provides a variety of useful background information on RFETS water and wastewater management. The IWMP and updates should be reviewed during project scoping to determine if on-site wastewater treatment capacity is available for project activities.

As closure activities proceed at RFETS, and wastewater treatment capacity is gradually reconfigured or removed from service, each project will have increasing responsibility to provide project-specific water management and wastewater treatment capacity. To expedite any NPDES permitting that may be required, RFCA provides for a consolidated review process (See RFCA ¶ 101 and ¶103). Depending on project complexity, the consolidated review process represents a commitment by EPA and CDPHE to perform review and public comment on permit applications concurrent with the accelerated action decision process. In addition, the consolidated review process is not supposed to require more time for approval than would otherwise be required under the IM/IRA or PAM process (See RFCA ¶99).

#### **Spill Prevention Control and Countermeasures/Best Management Practices Plan and Storm Water Pollution Prevention Planning**

RFETS is subject to regulatory requirements to have a spill prevention program and to implement best management practices (BMPs) to prevent oil and hazardous substances, respectively, from entering waters of the United States. Under the CWA, a spill prevention plan is required to prevent the release of oil in harmful quantities, which are defined as follows:

*For purposes of section 311(b)(4) of the Act, discharges of oil in such quantities that the Administrator has determined may be harmful to the public health or welfare or the environment of the United States include discharges of oil that*

- (a) Violate applicable water quality standards, or*
- (b) Cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines*

BMPs are not specified in regulation, but, rather, rely on professional judgment as to the appropriate measures to take. BMPs that prevent stormwater from coming into contact with hazardous substances and barriers to prevent materials from entering surface waters are commonly employed under these requirements.

Other activities may be subject to the substantive requirements of the regulations as ARARs. In addition, some of the construction activity associated with decommissioning will be subject to select substantive requirements of the General Stormwater Permit for Construction Activities. By virtue of the CERCLA permit waivers (Section 2.6.1), formal notification under that General Permit is not required for decommissioning in the Industrial Area or accelerated actions conducted in the Buffer Zone.

Any construction activity where conditions exist that are different enough that it would be appropriate for an individual permit, may be subject to additional monitoring or substantive requirements not contained in the General Stormwater Permit for Construction Activities. Such conditions could include construction in a location contaminated from past industrial activities or where stormwater from the construction site comes into contact with industrial or process wastes. Such locations would have to be outside the Industrial Area, which is already covered by a stormwater permit. The general permit is designed for use where the primary contamination anticipated is suspended solids mobilized by precipitation. However, water that falls on the site as "stormwater" may remain stormwater. Each proposed construction activity must be evaluated individually, with particular attention to the location's proximity to contamination, the proposed time frame, and the type of construction.

Stormwater and groundwater accumulation may also fall under the Site's procedure for the management of incidental water, Control and Disposition of Incidental Waters (1-C91-EPR-SW 01 Rev. 2). The procedure establishes approved methods for disposing of water accumulated after storm events or as a result of seepage, and provides current information about organizations and points of contact.

### **2.5.3. National Environmental Policy Act**

In accordance with RFCA §95 and the June 1994 DOE Secretarial Policy on NEPA, decision documents prepared under RFCA are to incorporate NEPA values. RFCA decision documents that are subject to public and/or agency review before the actions they describe are taken, ordinarily will not require separate RFETS NEPA documentation (e.g., a categorical exclusion or an environmental assessment). Those not subject to public review before action is taken, typically will require NEPA documentation. A draft of all RFCA decision documents must be submitted to the RFETS NEPA group for review to determine if

- (1) Separate NEPA documentation is required, and
- (2) NEPA values have been adequately incorporated

To ensure NEPA equivalence, it is also necessary to include a "no action" alternative in the alternatives analysis for all IM/IRAs, PAMs, Decommissioning Operations Plan (DOPs), and RFCA Standard Operating Protocol (RSOPs).

For decommissioning activities, it is expected that NEPA values will be incorporated into the DPP. Any decommissioning not covered by the DPP will be subject to the process described above for decision documents.

After consultation with the stakeholders, or as a matter of policy, DOE RFFO may choose to prepare separate NEPA documentation for an action. If separate NEPA documentation is required, submittal of a project to the RFETS NEPA group for review should be by letter, preferably with a completed environmental checklist. Environmental checklist forms are available from the RFETS NEPA group. NEPA documentation, if required, would be a categorical exclusion or an environmental assessment.

Many projects may be categorically excluded from the NEPA requirements unless there are factors that make a categorical exclusion inappropriate. Such factors include high levels of radiation, other risk factors, or impacts to wetlands, threatened and endangered species habitat, or other environmentally-sensitive areas. Projects that may be categorically excluded must still receive documented approval. If a project is not eligible for a categorical exclusion, an environmental assessment will be required.

#### **2.5.4. Air**

RFETS is subject to the Colorado Air Pollution Prevention and Control Act and implementing regulations. An operating permit for RFETS is currently under development by the Colorado Air Pollution Control Division (CAPCD). To expedite any air permitting that may be required, RFCA provides for a consolidated review process (See RFCA §101). The consolidated review process represents a commitment by EPA and CDPHE to conduct review and public comment on permit applications concurrent with the accelerated action decision process. In addition, the consolidated review process is not supposed to require more time for approval than would otherwise be required under the IM/TRA or PAM process (See RFCA §99).

The type of air permitting required is determined by an evaluation of the activity's potential to emit air pollutants and the site's total emission inventory. In general, activities with potential emissions of less than 1 or 2 tons per year, for the major pollutants, or other various thresholds for hazardous air pollutants are not subject to air permitting. In some cases, a commitment to abide by existing site procedures (e.g., dust control) can be sufficient to ensure that emissions remain below permitting thresholds. At higher levels of emissions, RFETS may be required to submit air permits and Air Pollutant Emission Notices (APENs). APENs are used by CDPHE to inventory emissions for planning purposes and attainment demonstrations. Modification to the RFETS Title V Operating Permit (or permit application) may be required. The regulations require that quantified emission estimates be included in the application.

Umbrella or "bubble" type permits can also be obtained. This type of permit allows RFETS contractors and subcontractors to conduct multiple excavation, clean-up, or demolition operations under a single permit that contains specified limits of annual pollutant emissions, scope definition, and control requirements. Grouping of multiple operations on a single permit is allowed by the CAPCD, provided aggregated sources are related. Once obtained, any project subject to the permit terms and conditions is required to document specified operation parameters to demonstrate compliance. The emission limitations established for bubble permits will allow for multiple projects annually. As long as the total permitted annual emissions are not exceeded and the controls specified in the permit are employed, no additional permitting or public comment is required. Questions and clarifications on air permit requirements should be directed to the RFETS air group.

### **2.5.5. Ecological Concerns**

As a federal natural resource trustee, DOE RFFO (and its contractors) must act in the public interest with regard to conservation of natural resources. As a result of this responsibility, to ensure compliance with applicable regulatory requirements, ecological concerns must be addressed during project planning at RFETS. Compliance with the Endangered Species Act, Fish and Wildlife Coordination Act, Migratory Bird Treaty Act (MBTA), CWA, and the Colorado Nongame, Threatened, and Endangered Species Act is required for RFETS activities. Several DOE policies and orders also mandate protection of ecological resources.

Many wildlife species at RFETS are managed and protected by the State of Colorado. Penalties for violations of state wildlife protection laws can include fines, compensation for damages, or imprisonment. The U.S. Fish and Wildlife Service administers the Endangered Species Act, the Fish and Wildlife Coordination Act, and the MBTA. These acts provide protection of ecological resources from harm. The regulatory agency with the lead for making decisions related to wildlife issues should be determined during project scoping.

Pursuant to the CWA, both the EPA and the U.S. Army Corps of Engineers (USACE) have jurisdiction over activities that affect RFETS wetlands. Generally, the EPA has jurisdiction over CERCLA activities, and the USACE has jurisdiction over non-CERCLA activities. The EPA reserves the right to make all jurisdictional determinations. If a project will affect wetlands, a mitigation plan must be developed and in place prior to beginning work. In addition to CWA requirements, DOE RFFO is required to protect wetlands under Executive Order 11990. Finally, wetlands impacts must be considered whenever water treatment and operations practices are modified or eliminated.

Prior to the start of work, RFETS activities must be evaluated by a qualified ecologist for potential to impact the Preble's Meadow Jumping Mouse (a resident threatened species), migratory birds, threatened or endangered species and their habitats, and wetlands. Any outdoor work area must be surveyed in accordance with procedures 1-D06-EPR-END 03 (K-H, 1994a) and 1-G98-EPR-END 04 (K-H, 1994b).

If a protected species is found to be present at a work site, work may be delayed until consultation with the U S Fish and Wildlife Service has been completed This is now particularly true if work will be in or may affect riparian areas on the site, because the Preble's Meadow Jumping Mouse, a species that lives in these areas, is listed as a threatened species (63 FR 26517-26530, May 13, 1998)

Other resource protection issues of importance at RFETS include weed control and revegetation Weed control on federal lands is mandated by the Federal Noxious Weed Act, the Colorado Weed Management Act, and the Jefferson County Undesirable Plant Management Plan In areas where long-term soil disturbances will occur, or where revegetation will be done, projects must budget appropriate funds to meet weed control needs Revegetation with native plant species and limitation of the size of a surface disturbance is controlled by DOE Order 6430 1A (DOE, 1989)

The Natural Resources Management Policy (NRMP) establishes natural resource policies for management of the Buffer Zone It is based on the open space cleanup objective expressed in the RFCA Vision The NRMP will guide selection and funding of Buffer Zone management activities while the Site is being cleaned up under RFCA

Consistent with the RFCA Vision, DOE RFFO will manage resources during cleanup to preserve currently available options for Buffer Zone open space use to facilitate post-closure resource management discussions In addition, the NRMP will establish policies for addressing natural resource damage issues under CERCLA

#### **2.5.6. Health and Safety**

The regulatory authorities for worker health and safety during activities conducted pursuant to RFCA are the Occupational Safety and Health Act (OSHA) requirements found at 29 CFR Parts 1910 and 1926 and DOE Order 440.1 (DOE, 1995h) DOE Order 440 1, entitled "Worker Protection Management", obligates DOE RFFO's contractors to comply with the OSHA 29 CFR Parts 1910 and 1926 requirements The requirements embodied in the OSHA regulations are addressed in the RFETS Health and Safety Practices manual (K-H, 1997), specifically HSP 21 03

RFETS has an Integrated Safety Management (ISM) program that is implemented for each work activity Consistent with the site's ISM program, hazards associated with executing the work are identified and controls are put in place to mitigate the hazards to the performance of any field work

### **3. TECHNICAL APPROACH AND PROCEDURES**

All remediation work at RFETS will be conducted as an accelerated action for one or more IHSSs or buildings, a closure plan for RCRA regulated units, or pursuant to a CAD/ROD for an Operable Unit (OU) (See RFCA ¶96). Decommissioning will be performed as described in a PAM, IM/IRA (described in the DPP), or as described in individual DOPs for more complex activities. Deactivation, decontamination, and decommissioning will be integrated with ER to ensure efficiency between programs.

To expedite remediation work and maximize accelerated risk reduction, DOE RFFO will make extensive use of accelerated actions for buildings, IHSSs, Potential Areas of Concern (PACs), and Under Building Contamination (UBC). For ease of discussion, "IHSSs," "PACs," and "UBCs" will all be termed as "IHSSs" for the remainder of this document.

The focus of the RFETS ER Program is on cleanup. The decision process will be developed using a bias for action that (1) identifies IHSSs or evaluates the Site for risk, (2) determines whether a cleanup is necessary, and if so, evaluates whether the IHSS is appropriate for an accelerated action, and (3) ranks the area relative to other IHSSs. The ER process flow is shown in Figure 3-1.

Since 1995, the ER Ranking has been the tool to implement this bias for action by focusing on addressing high-risk sites before low-risk sites, thus more quickly reducing risks to human health and the environment.

In the future an opportunistic approach will evaluate the accessibility of an area and what, if any, potential future impacts exist due to other remedial actions in the area.

During the remediation of the IA, ER representatives will be coordinating with decommissioning representatives as early as possible to understand the building history, remediation schedule, and what IHSS, including PAC and UBC conditions, may exist. Early coordination will increase efficient use of resources. However, any time it is determined that an IHSS is impacting human health or the environment, such that immediate action is warranted, then action will be taken as soon as possible.

Following completion of all accelerated actions, including decommissioning, the residual risks in the Industrial Area and the Buffer Zone will be evaluated (See Section 3.6.3).

#### **3.1. ENVIRONMENTAL RESTORATION PROCESS AND DOCUMENTS**

The IAG (DOE, 1991) created 16 OUs. By the time RFCA was signed in 1996, OUs 11, 15, and 16 had been closed by means of CAD/RODs. Attachment 1 to RFCA and a prior modification to the IAG consolidated the remaining thirteen OUs into seven OUs.

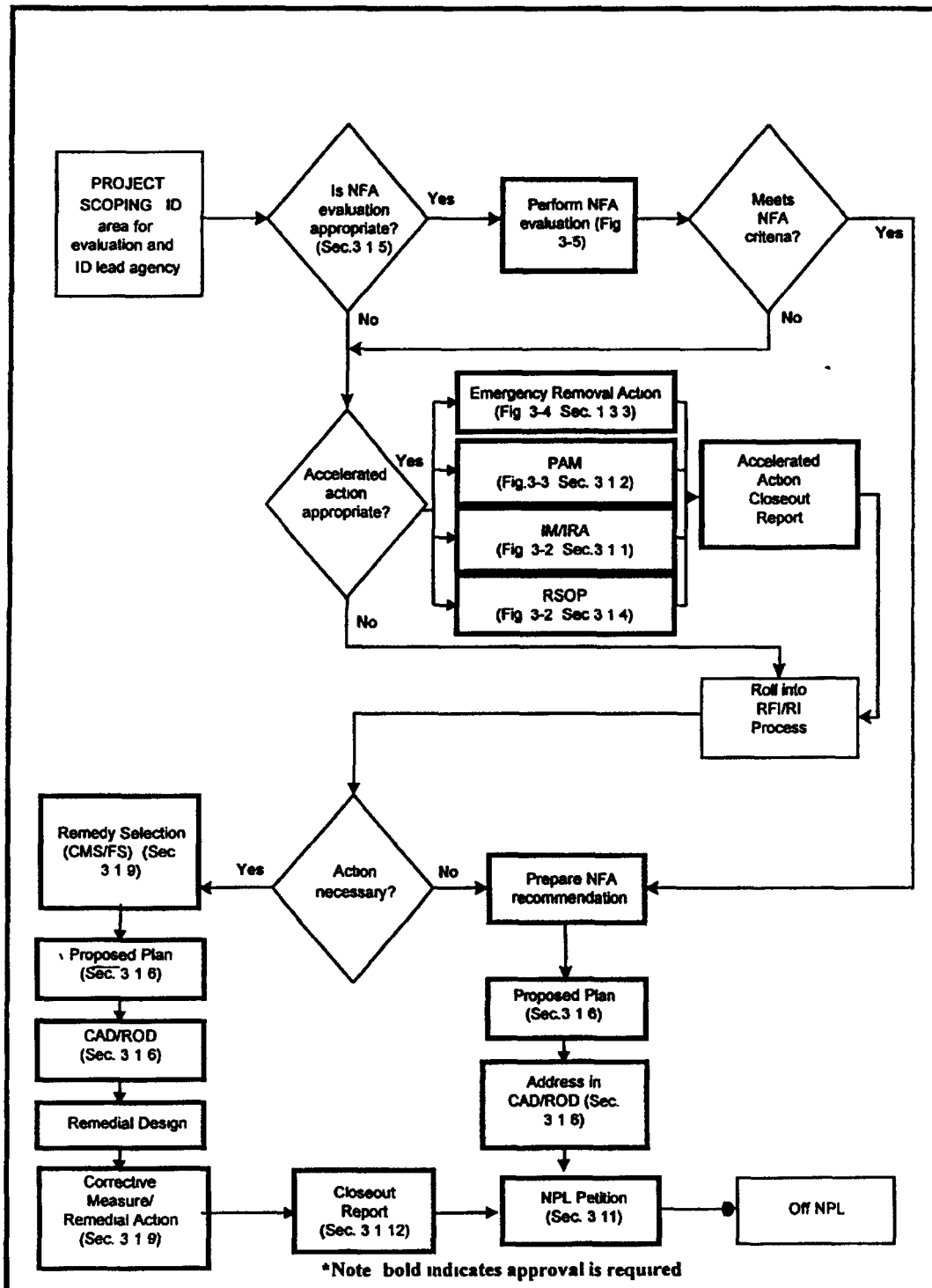


Figure 3-1 Environmental Restoration Process Flow

Development of RFETS-specific documents is described with accompanying flow charts in the following sections. Development of standard CERCLA documents will be in accordance with the NCP and other available EPA guidance documents.

In developing any RFETS decision document, DOE RFFO will meet with the regulators to present the approach to a given remedial action (See Section 2.0). Once the approach is agreed upon by all parties, development of the decision document will proceed as outlined below.

RFCA identifies several types of decisions for action or no action:

- IM/IRAs will be developed when a formal evaluation of remedial options is necessary or remedial activities are estimated to require more than six months from commencement of physical work to completion. The requirements for IM/IRAs are discussed in Section 3.1.1 and Appendix B.
- PAMs will be used where remedy selection is straightforward, and remedial activities are estimated to take less than six months from commencement of the physical work to completion. The requirements for PAMs are described in Section 3.1.2 and Appendix C.
- Emergency Removal Actions are discussed in Section 3.1.3.
- No Action and No Further Action decisions for IHSSs will be documented in updates to the Historical Release Report (HRR), as described in Section 3.1.5 and detailed in Attachment 6 to RFCA.
- CAD/RODs have been or will be developed by DOE RFFO for OUs 1, 3, 5, 6, 7, 11, 15, and 16. Future CAD/RODs will be developed to document the final corrective action/remedial decision for the Buffer Zone and the Industrial Area. Development of CAD/RODs will follow EPA guidance. The RFCA approach to CAD/RODs is described in Section 3.1.6.

The RFCA also identifies RSOPs that are applicable to routine ER and/or decommissioning activities that DOE RFFO may repeat without obtaining additional approval. Initial approval of an RSOP will be through the IM/IRA process (See RFCA ¶25b). The requirements for RSOPs are addressed in Section 3.1.4 and Appendix D.

- DOPs for complex decommissioning activities will be reviewed by the LRA via either the PAM or IM/IRA review process (See RFCA ¶121).

Supporting documents identified in RFCA that may be required for an IHSS to reach the decision document stage, may include RCRA Facility Investigation/Remedial Investigation (RFI/RI) work plans and reports and Corrective Measure Study/Feasibility Studies (CMS/FSs), which are part of the CAD/ROD process. Other supporting documents identified in RFCA are Sampling and Analysis Plans (SAPs), Technical Memoranda (TM),

Closeout Reports, and Treatability Study Reports where necessary. The development of SAPs is discussed in Section 3.2 and the development of TMs is discussed in Section 3.1.9.

Appendices to this document are included that discuss the development of RFETS-specific documents. When documents will be developed using the standard CERCLA approach, the EPA guidance for developing these documents is cited.

The document review process is similar for all of the major documents identified in RFCA. Specific document review processes and times are found in Part 9 of RFCA. Generic schedules and suggested document formats are included with the IGD appendices.

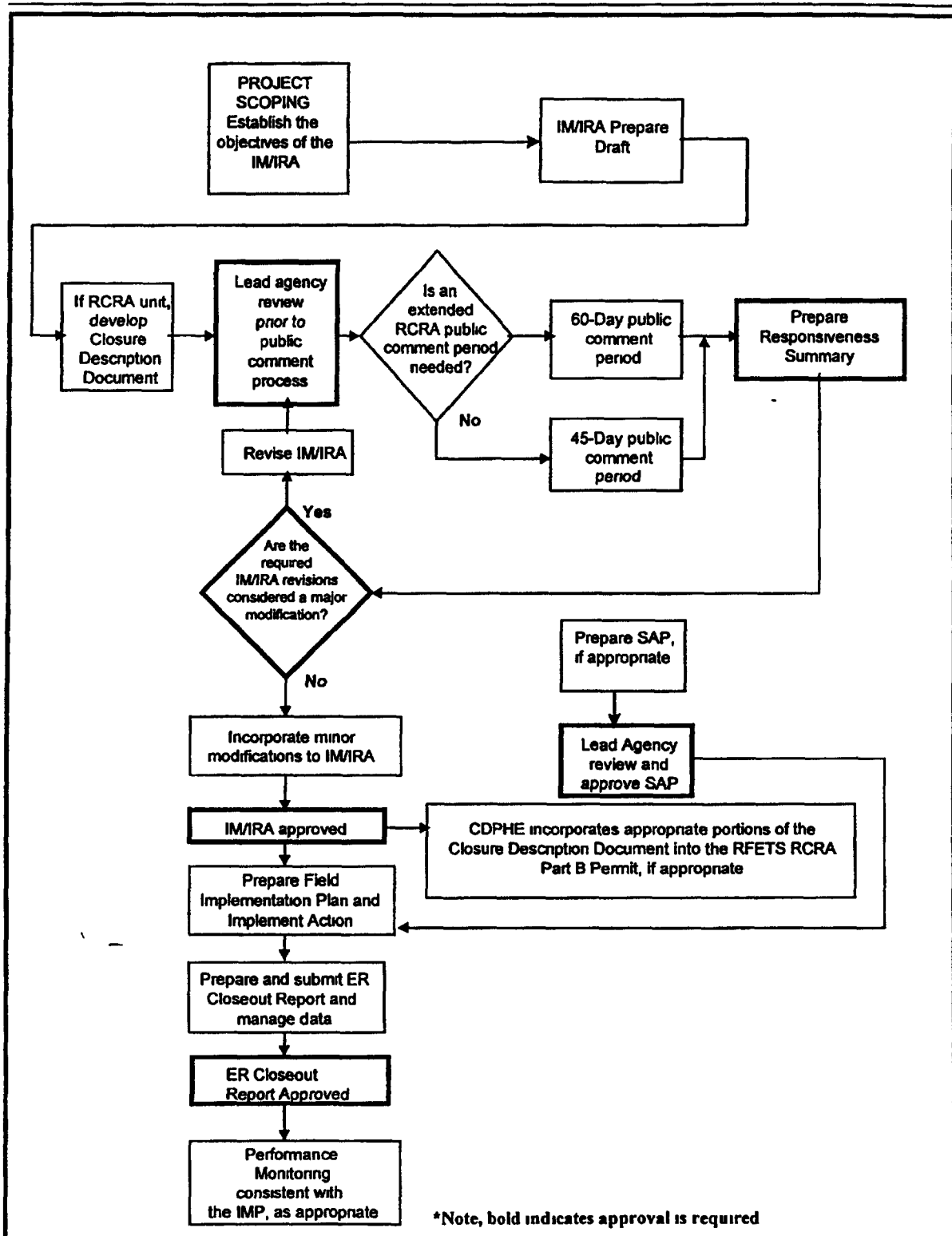
During the public comment period, and after consultation with and approval by the LRA, DOE RFFO may initiate certain preliminary activities. These preliminary activities may include conducting appropriate sampling in accordance with the approved SAP and conducting any studies and administrative activities prerequisite to implementing the accelerated action.

If public comments are received, the approved Responsiveness Summary will be placed in public information repositories before the accelerated action is initiated except with regard to the preliminary activities described above. DOE RFFO will keep the LRA apprised of the progress of the activities required for implementation of the accelerated action through the monthly RFCA project coordinators meeting and the quarterly RFCA progress reports. (See RFCA §§ 262 and 263)

### **3.1.1. Interim Measure/Interim Remedial Action Decision Documents**

IM/IRAs apply to interim remedial activities or removal actions that are estimated to take more than six months from the commencement of physical work to completion. (See RFCA §107) Remedial activities performed under an IM/IRA will, to the extent practicable, be consistent with and contribute to the efficient performance of any anticipated long-term remedial action. The IM/IRA may also serve as a RCRA Part B permit modification, when indicated in the document. If CDPHE determines that an activity constitutes a RCRA Class 3 permit modification, the IM/IRA will be subject to the public comment process outlined in RFCA §108. The IM/IRA process is shown in Figure 3-2. Section 3.10 describes the process for modifying approved decision documents.

IM/IRAs will also be developed for accelerated actions where several remedial options are available. These IM/IRAs will evaluate multiple alternatives and justification of the selected alternative.



**Figure 3-2 Environmental Restoration Interim Measures/Interim Remedial Action (IM/IRA) Process**

The IM/IRA process requires production of three documents: the IM/IRA, the SAP, and the Closeout Report. Public comments are received and a formal responsiveness summary is included with the final IM/IRA. The responsiveness summary may also be prepared as a separate document. The document schedule will be set during Project Scoping consistent with RFCA §§ 89, 107, and 108.

A SAP (see Section 3.1.8) is prepared concurrently with the IM/IRA and is finalized during the public comment period. Although the SAP is submitted to the agencies for review and approval, it is not reviewed by the public because of the technical detail. Any additional documents necessary to execute the accelerated action should be made available to the agencies and the public, but they are not subject to agency approval or public comment. These documents include the Health and Safety Plan (HASP), the Hazards Analysis (HA), Readiness Analysis, and the Field Implementation Plan (FIP). Although this type of information is vital to performing the action, it is not part of the RFETS authorizing sequence.

IM/IRA format and contents are discussed in Appendix B, Preparation of an IM/IRA. Consistent with RFCA §107, an IM/IRA includes

*[A] brief summary of data for the site, a description of the proposed action, an explanation of how waste management considerations will be addressed, an explanation of how the proposed action relates to any long-term remedial action objectives, proposed performance standards, all ARARs and action levels related to the proposed action, and an implementation schedule and completion date for the proposed action*

Performance monitoring is required for all groundwater remedies and should be noted in the IM/IRA. Details of the performance monitoring will be developed as part of the project-specific remedial decision document and implemented through the IMP described in Section 3.1.4 (DOE, 1998). Performance monitoring will be required for some soil remedies, and, if appropriate, identified in the IM/IRA. (See Section 3.4.E of the ALF). To meet NEPA requirements, screening of alternatives, including no action, is required and will use the EPA Engineering Evaluation/Cost Assessment (EE/CA) process for streamlined alternatives analysis as guidance. EE/CA guidance is found in EPA *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (EPA, 1993). The schedule for developing an IM/IRA will follow the document review schedule outlined in §107 of RFCA (or §108, if applicable).

### **3.1.2. Proposed Action Memorandum**

The PAM is the primary planning and implementation document for ER accelerated actions. Actions expected to take less than six months from commencement of construction to completion may be approved under the PAM process. (See RFCA §106). Closeout reports

for actions performed under PAMs will have the same requirements and format as for actions performed under IM/IRAs. The purpose of the PAM is to describe the nature of the contamination, the proposed mitigating action, and an implementation schedule. The PAM preparation process is summarized in Figure 3-3. The PAM may also serve as a RCRA Part B permit modification, where indicated.

The PAM process requires completion of three documents: the PAM, the SAP, and the Closeout Report. PAMs are typically brief documents (four to thirty pages in length) and reference existing information, previously published, and available documents detailing earlier field investigations. PAMs for accelerated actions are coordinated closely with EPA and CDPHE to minimize the number and duration of review cycles. If public comments are submitted, a formal responsiveness summary will be included with the final PAM, which is revised as necessary. Section 3.10 describes the process for modifying approved decision documents.

A SAP (see Section 3.1.8) is prepared concurrently with the PAM and finalized during the PAM public comment period. Although the SAP is submitted to the agencies for review and approval, it is not reviewed by the public because of the technical detail. Additional documents necessary to execute the PAM should be made available to the agencies and the public, but they are not subject to agency approval or public comment. These documents include the HASP, the HA, and the FIP. Although this type of information is vital to performing the action, it is not part of the RFETS authorizing sequence.

Details of PAM preparation are found in Appendix C. Consistent with ¶106 of RFCA, a PAM includes

*[A] brief summary of data for the site, a description of the proposed action, an explanation of how waste management considerations will be addressed, an explanation of how the proposed action relates to any long-term remedial action objectives, proposed performance standards, all ARARs and action levels related to the proposed action, and an implementation schedule and completion date for the proposed action*

Performance monitoring is required for all groundwater remedies and should be described in the PAM. Details of the performance monitoring will be developed as part of project-specific remedial decision document and implemented through the IMP described in Section 3.14 (DOE, 1998). Performance monitoring will be required for some soil remedies and, if appropriate, identified in the PAM. (See Section 3.4.E of the ALF)

The schedule for developing a PAM will closely follow the document review schedule outlined in ¶106 of RFCA, and is illustrated in Appendix C.

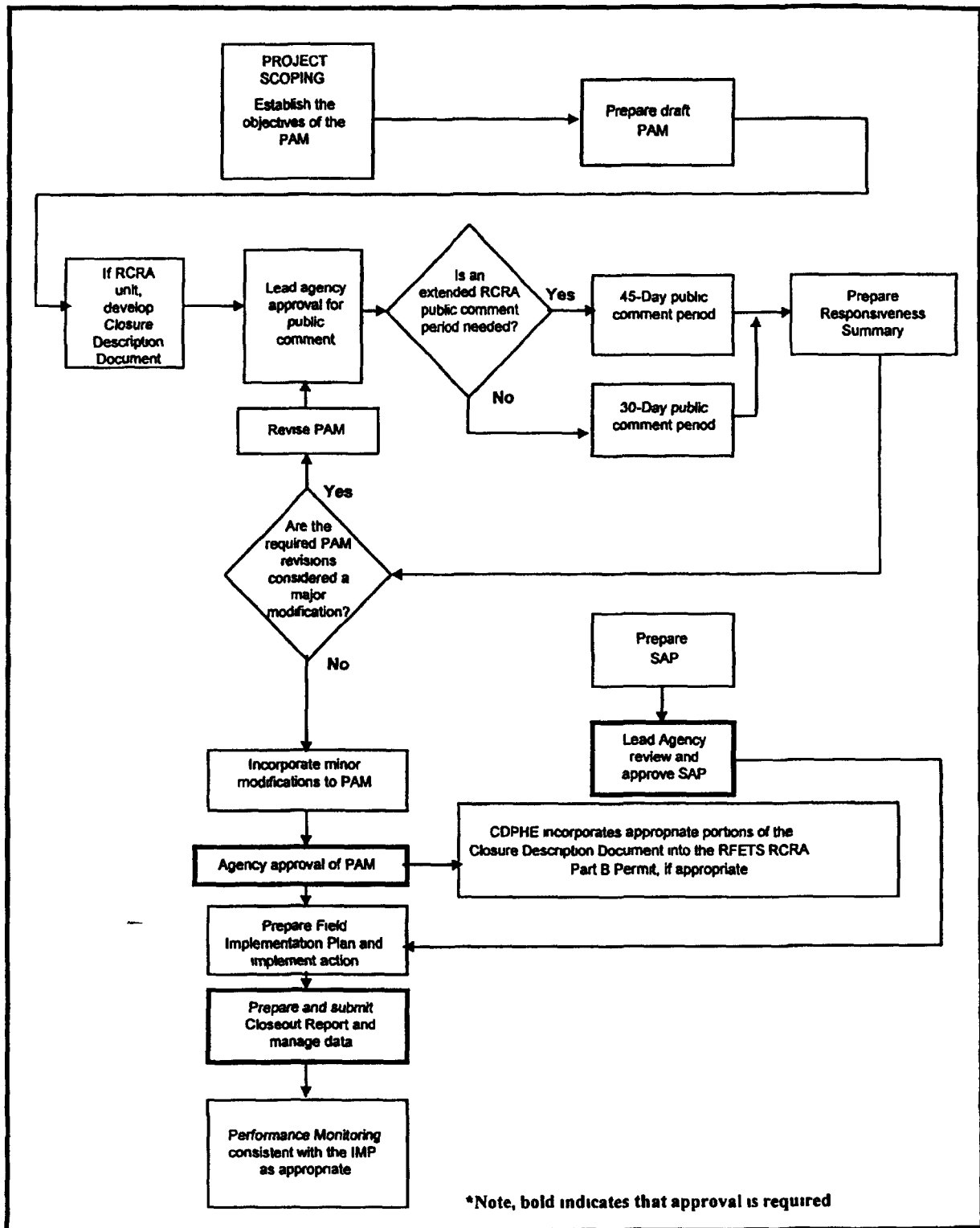


Figure 3-3 Proposed Action Memorandum (PAM) Process

### 3.1.3. Emergency Removal Actions

RFCA ¶96 governs Emergency Removals as follows

*DOE may initiate a time-critical removal action if it determines, in accordance with the National Contingency Plan, that an immediate response is needed to eliminate or abate a release or substantial threat of release of a hazardous substance posing an immediate and substantial endangerment to the public health and welfare or the environment. DOE shall notify EPA and CDPHE within 24 hours of this determination. Once the immediate threat has been averted or mitigated, DOE shall propose any further actions that may be necessary in accordance with the provisions of this Part or Part 10, as appropriate.*

If the RCRA Contingency Plan is activated, the regulators are notified through that process. Otherwise, the DOE RFCA Project Coordinator will notify the other parties.

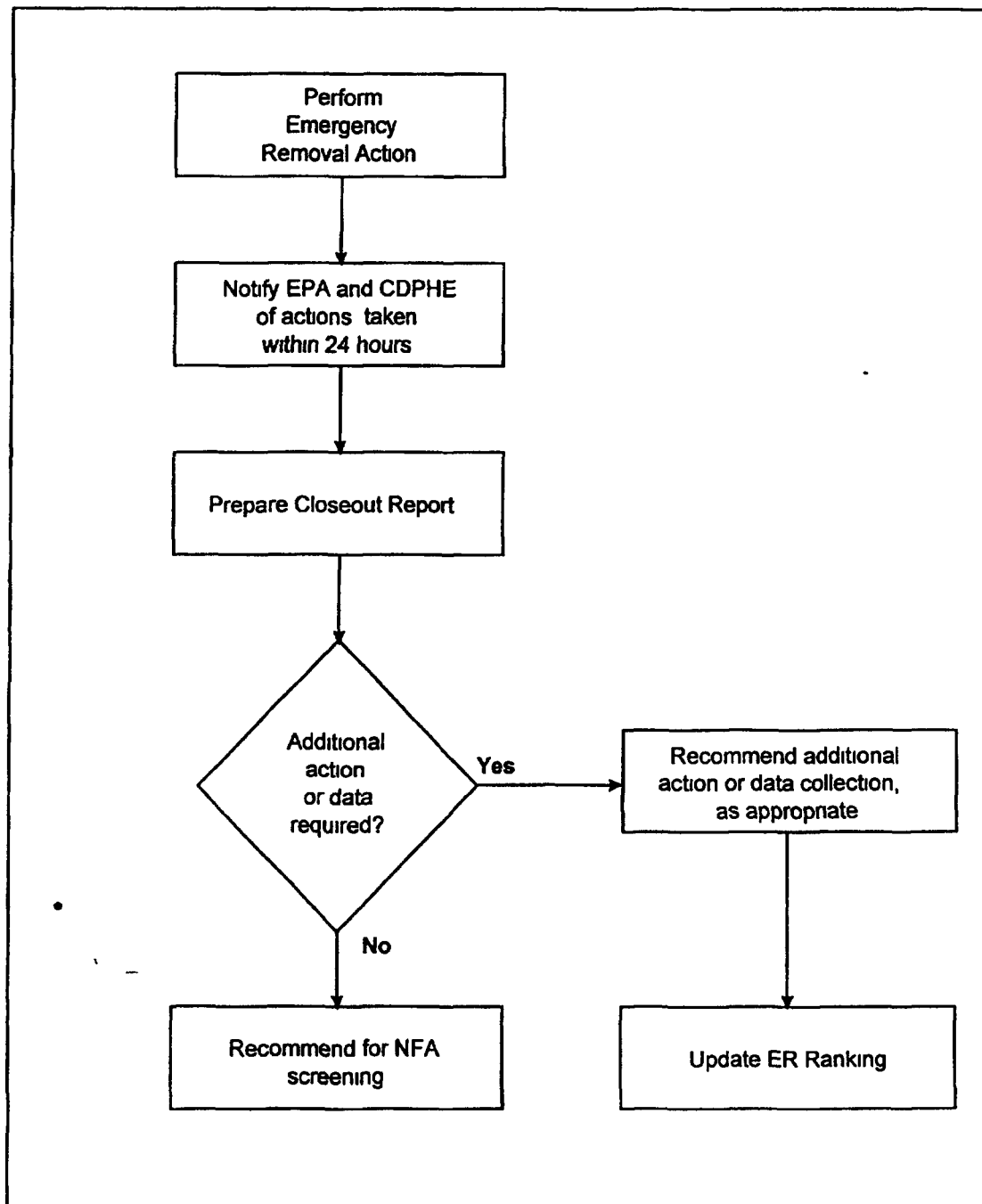
The Emergency Removal Action process is depicted in Figure 3-4 and will be documented in a Closeout Report that follows the outline presented in Section 3.1.2. The Closeout Report will assess whether additional evaluation is needed or if sufficient data are available to evaluate for No Action/No Further Action (NFA). The removal action will be incorporated into the annual update of the HRR.

### 3.1.4. RFCA Standard Operating Protocols

RSOPs

*apply to accelerated actions that are routine and substantially similar in nature, for which standardized procedures can be developed. (See RFCA ¶96)*

RSOPs may be developed for remedial actions where the same approach will be applied to several different IHSSs or buildings. An example of an ER RSOP would be a generic plan for cleaning and rendering tanks inert. Review and approval of RSOPs will follow the document review process of IM/IRAs. The public comment period for RSOPs will follow the IM/IRA process. An approved RSOP is implemented by notifying the other RFCA parties. (See RFCA ¶25) RSOP format and contents are discussed in Appendix D, Preparation of an RSOP.



**Figure 3-4 Emergency Removal Action**

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### 3.1.5. No Further Action Decisions

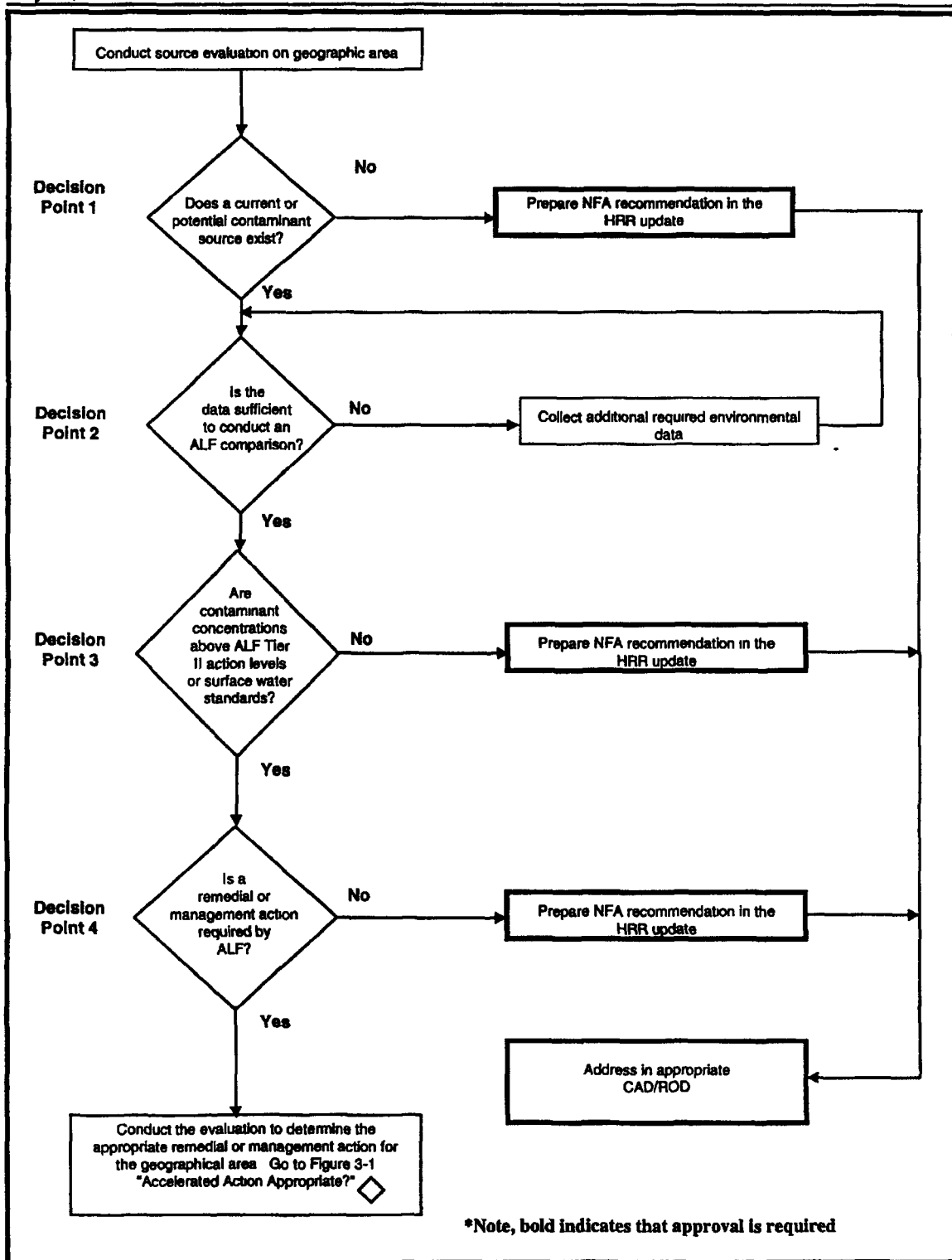
The criteria and documentation requirements for determining if a geographic area (IHSS, PAC, UBC, Source Area, OU, or Area of Concern [AOC]) can be recommended for NFA are detailed in RFCA Attachment 6. The NFA decision process presented within RFCA Attachment 6 meets the substantive requirements to support an NFA (as defined by CERCLA) remedy selection for a CAD/ROD. As in Attachment 6, the acronym "NFA" represents all circumstances under which an NFA decision may be warranted at RFETS.

- When the geographic area poses no current or potential threat to human health or the environment (**no action decision**)
- When a previous response eliminated the need for further response or when the ALF in RFCA Attachment 5 indicates institutional controls alone will constitute acceptable risk management (**no further action decision**)

Since RFCA and ALF incorporate institutional controls, an NFA decision will imply the implementation of institutional controls and indicates that institutional controls alone will constitute acceptable risk management. An NFA decision will mean that no (further) treatment or engineering controls are warranted for a specific geographic area, but will allow future monitoring.

RFCA Attachment 6 provides decision criteria for establishing those geographic areas at RFETS not requiring further study or remediation as part of the CERCLA process. This NFA decision process is shown in Figure 3-5 and summarized below.

- 1 **Conduct source evaluation** – If a review of historical release information/defensible data reveals that no current or potential contaminant source exists, then the exposure pathway is incomplete and the geographic area may be recommended for NFA.
- 2 **Conduct data evaluation** – If the available data are not of sufficient quality or quantity to evaluate a geographic area by means of the ALF, then additional environmental data must be collected.
- 3 **Conduct an ALF comparison** – If media-specific environmental data collected from the geographic area are below surface water action levels or Tier II action levels for groundwater or soils, the geographic area may be proposed for NFA.
- 4 **Determine required actions** – If action levels for any medium are exceeded, remedial or management action or an evaluation is required. If an evaluation demonstrates that no action is required to protect surface water and ecological resources, the area may be proposed for NFA.



**Figure 3-5 Decision Points for No Action or No Further Action Recommendations**

In addition to the NFA decision process described above, a risk evaluation may be performed on specific geographic areas to justify NFA. If that risk evaluation is based on a residential exposure scenario (such as the CDPHE conservative screen), a NFA decision without institutional controls may be justified.

The rationale for an NFA decision will be summarized in an update to the HRR, and appropriate supportive documentation will be appended, as necessary (See Section 3.8.2). Geographic areas documented in this manner will incur minimal administrative attention and costs while awaiting final disposition in a CAD/ROD. This process also removes any impediment the area might otherwise impose on adjacent or overlapping activities. All NFA decisions documented in this manner are subject to review in a CAD/ROD. Other administrative requirements for coordination of NFA decisions with the CAD/ROD process and with RCRA closures at RFETS are discussed in RFCA Attachment 6. A generic schedule for the NFA process is included in Appendix E.

#### **3.1.6. Proposed Plans and Corrective Action Decision/Record of Decision**

CAD/RODs apply to the final corrective action/remedial decision made for an OU or a group of OUs following implementation of all accelerated actions (See RFCA ¶96). CAD/RODs have been or will be completed for OUs 1, 3, 11, 15, and 16. The consultative process provides a mechanism for the Site to consider several options (e.g., single or multiple CAD/RODs) during development of a final CAD/ROD strategy.

Individual IHSSs will be recommended as NFA sites or will be cleaned up through accelerated actions. The residual contaminant levels following accelerated actions will be documented in the various Closeout Reports, the HRR, the RFETS Soil Water Database (See Appendix F) and will be assessed in the CRA. The NFA recommendations and the results of the accelerated actions will support the preparation of the final CAD/ROD(s), regardless of which proposed CAD/ROD strategy option is implemented.

For the Industrial Area OU, CDPHE will make a recommendation to EPA whether to concur with DOE's proposed remedial decision for radionuclides and other hazardous substances that are not hazardous constituents (See RFCA ¶84). This remediation decision will be presented to the public in a Proposed Plan (PP), and finalized in a CAD/ROD. The PP and the CAD/ROD will be developed following the *Interim Final Guidance on Preparing Superfund Decision Documents* (EPA, 1989a).

For the Buffer Zone OU, following implementation of all planned accelerated actions, EPA and DOE RFFO will make a final remedial decision. The Buffer Zone remediation decision will then be presented to the public in a PP and finalized in a CAD/ROD.

### Proposed Plan

Preparation of the PP is described in the *Interim Final Guidance on Preparing Superfund Decision Documents (EPA, 1989a)*. If a CAD/ROD is proposed that requires action, the purpose of a PP is to facilitate public participation in the remedy selection process by

- Identifying the preferred alternative for a remedial action at a site or OU and explaining the reasons for the preference
- Describing other remedial options that were considered in detail in the CMS/FS
- Soliciting public review and comment on all of the alternatives described
- Providing information on how the public can be involved in the remedy selection process

When a NFA CAD/ROD is proposed, the purpose of the PP is to facilitate public participation by

- Explaining the basis of the no action or no further action alternative
- Describing the accelerated actions taken and the results of those actions
- Soliciting public review and comment on the no action or no further action alternative
- Providing information on how the public can be involved in the final decision to take no action or no further action

A PP is a public participation document that is expected to be widely read. Therefore, it should be written in a clear and concise manner using non-technical language and should not exceed five to ten pages. In addition, it should direct the public to the RFI/RI and CMS/FS reports, accelerated action closure reports, and other Site-specific information as the primary source of detailed information on the remedial alternatives analyzed.

For the OUs at RFETS, the PP should list the IHSSs that have been addressed through the NFA process that will be included in the CAD/ROD for the OU. A table format is recommended for listing the IHSSs or buildings, how they were closed, and each IHSS or Closeout Report.

A PP should relate the findings of the RFI/RI, CRA, and CMS/FS in a brief, non-technical format. The information should be presented in support of the preferred alternative (including the no action or no further action alternative) and discuss how it is protective of human health and the environment.

A PP should clearly state that the LRA and DOE has identified a preferred alternative based on available information, but they have not "selected" a remedy to implement. A PP supports only preliminary decisions for an OU, and it should not make definitive findings or declarative statements that would be difficult to revise later.

A PP should emphasize that the preferred alternative is only an initial recommendation. It should clearly state changes to or from the preferred alternative may be made, if public comments or additional data indicate that such a change would result in a more appropriate solution. The plan must also state that the final decision will be documented in the CAD/ROD after the DOE RFFO and the LRA have taken into consideration all comments from the SRA and the public.

The EPA guidance on preparing decision documents describes statutory requirements for a PP and suggests language for these sections. The guidance also includes a suggested outline and detailed suggestions for writing a PP, and describes how to address changes to the PP following public comment. A specific appendix on development of a PP is not included in the IGD because RFETS PPs are expected to follow the general process EPA outlined above.

#### **Corrective Action Decision/Record of Decision**

The CAD/ROD documents the remedial action plan for an OU. DOE RFFO and the LRA in consultation with the SRA will prepare the CAD/ROD. (See RFCA ¶83, 84, and 85 for discussion of regulatory authority over CAD/RODs). The CAD/ROD has the following purposes:

- To certify that the remedy selection process was carried out in accordance with the requirements of RFCA, CERCLA, and is consistent with the NCP
- To outline the engineering components and remediation goals of the selected remedy
- To provide the public with a consolidated source of information about the history, characteristics, and risks posed by the conditions at the Site, as well as a summary of the cleanup alternatives considered, their evaluation, and the rationale behind the selected remedy

The CAD/ROD consists of three basic components: (1) a Declaration, (2) a Decision Summary, and (3) a Responsiveness Summary.

The Declaration functions as an abstract for the key information contained in the CAD/ROD, and it is signed by the EPA, CDPHE, and DOE. The Decision Summary provides an overview of the Site characteristics, the alternatives evaluated, and the analysis of the remedial options. The Responsiveness Summary addresses public comments submitted on the PP, RFI/RI and CMS/FS report, and other information in the AR.

*The Interim Final Guidance for Preparing Superfund Decision Documents (EPA, 1989a)* includes a section-by-section discussion of the components of a ROD, and it should be followed in developing a RFETS CAD/ROD. RCRA units can be closed within the CAD/ROD. The EPA guidance also covers preparing a NFA ROD. Rather than repeat this well-developed information the reader is referred to this guidance and to previous RFETS CAD/RODs. Appendix G includes a generic PP/CAD/ROD development schedule.

### **3.1.7. RCRA Facility Investigation/Remedial Investigation Process**

Because remedial actions at RFETS have been combined into a limited number of OUs, only two RFI/RIs remain to be conducted. Other OUs have already been investigated under the RFI/RI process and are in various stages of completion. The CERCLA process for RI development will be followed for the Buffer Zone and Industrial Area OUs (EPA, 1988a). A flow diagram of the RFI/RI process, as envisioned for RFETS, is shown in Figure 3-6. When the RFI/RIs for the Buffer Zone and the Industrial Area are developed, all identified IHSSs should have undergone risk screening and should be identified for either an NFA recommendation or accelerated action. The RFETS RFI/RIs will integrate existing data and gather new data only where data gaps related to remediation are identified. Decision-making needs will be linked directly to data collection and will address RFCA requirements for environmental monitoring in accordance with the IMP.

The Industrial Area RFI/RI will be developed following remediation of the Industrial Area. The Industrial Area RFI/RI will focus on developing an Industrial Area conceptual model and the CRA. Areas that have not undergone accelerated action, deactivation, or decommissioning will be evaluated for further data needs. The need for collection of additional data will be determined during project scoping and development of the RFI/RI work plan. If enough data are available to determine the risk from the Industrial Area and further remediation is necessary to address the risk, any additional data collected will focus on selection and design needs.

The Buffer Zone RFI/RI process may not involve the gathering of new data, but will focus on developing the CRA. The CRA will compile the summary information and risk estimates from the previous Buffer Zone BRAs where possible. However, remedial actions, taken after production of the original BRAs, may render many of the estimates obsolete, and new estimates will have to be combined with those from the Industrial Area to determine the cumulative effects on some receptors. If additional action is needed as part of the final remedial action for the Buffer Zone, the remedy will either be selected through the CMS/FS process or a presumptive remedy will be used. The remedy selection will be documented in a PP/CAD/ROD. Appendix H includes a generic RFI/RI process schedule.

### **3.1.8. Sampling and Analysis Plans and Data Quality Objectives**

SAPs will be required in support of pre-remedial characterization, waste volume calculations, waste characterization, verification of cleanup, and design data needs. Data quality objectives (DQOs) will be developed for all sampling activities. Sampling plans and related DQOs will be focused on collecting data to meet a specific need (i.e., to address a specific decision). Decision-making needs will be linked directly to data collection. The purposes of the SAPs include

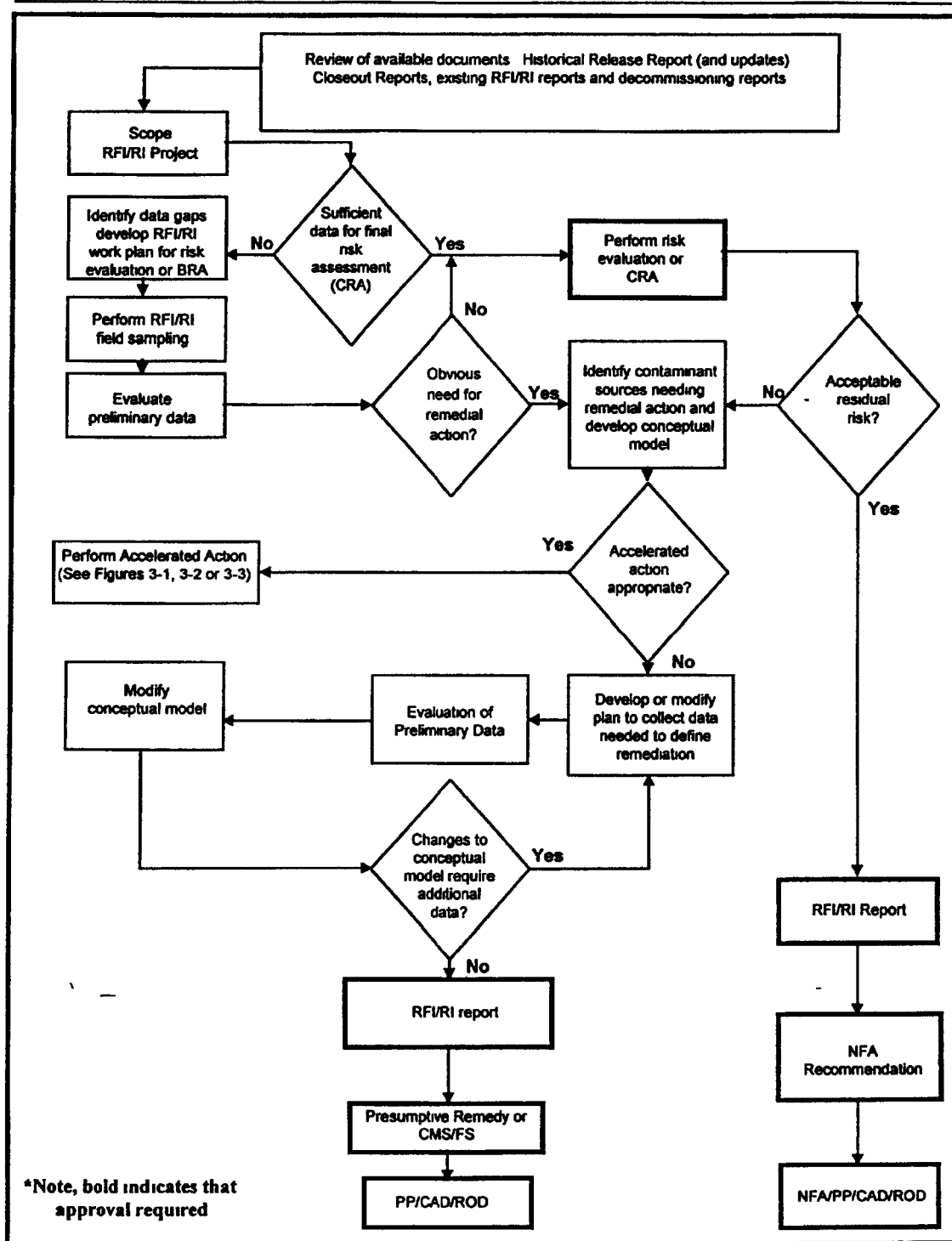


Figure 3-6 RCRA Facility Investigation/Remedial Investigation (RFI/RI)

- To document the decisions/uses for which data are needed, and the decision process used to determine the specific sampling approach
- To guide the field sampling crew in exactly what samples are to be collected, where and how they are to be collected, and what criteria trigger collection of additional or fewer samples
- The analytical methods to be used and the specific requirements of sample collection and handling for those methods

SAPs consist of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPjP) At RFETS, a Site-wide QAPjP has been developed Therefore, most SAPs consist of the FSP and discuss project-specific modifications to the QAPjP Because of this approach, data quality objectives focused on the project-specific data needs are developed within each SAP/FSP Development of SAPs is described in Appendix I

Data quality in terms of laboratory analytical methods will be focused on the primary and secondary data uses In general, SW-846 analytical methods are appropriate for the documentation of hazardous waste characteristics, for risk evaluation, and for the determination that soils remaining following a cleanup are below the levels specified in the decision document Radiological laboratory analysis will be performed under RFETS Statement of Work for Analytical Measurements Field screening data are generally sufficient to meet the DQO needs of gross volume calculations before excavation or for excavation control A statistical approach will be used, where appropriate, to determine the number of samples necessary to make a specific decision Data will not be collected unless a specific decision has been identified for the data.

In collecting characterization or design data, a conceptual model of the IHSS, specific release, or system to be addressed will be developed based on existing data and professional judgment The conceptual model will address contaminant transport issues such as expected presence of dense non-aqueous phase liquids, connection to higher permeability zones, and containment of the contamination by low permeability clays Development of a conceptual model incorporating available data assists in framing the questions that justify additional data collection

The IMP includes the sampling requirements for routine monitoring of surface water, air, and ecological resources This monitoring plan has involved extensive DQO evaluation for samples that are collected on a routine basis The IMP includes the location of collection points, frequency, method of sampling required, and analytical suites The IMP also describes reporting requirements and specific triggers to increase sampling frequency or perform additional evaluations

### 3.1.9. Corrective Measures Study/Feasibility Study

The CMS/FS identifies and evaluates appropriate corrective measures. "Corrective Measures Study" is a RCRA/CHWA term that is analogous to the CERCLA "Feasibility Study." Under RFCA, the CMS and FS may be the same document. (See RFCA §25v)

The CMS/FS developed at RFETS will be consistent with the NCP and with EPA feasibility study guidance (EPA, 1998a). The EPA proposed rule for Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities (55 FR 30798) and associated guidance will also be considered. Where appropriate, the CMS/FS will evaluate CHWA's closure and post-closure care requirements. A sample table of contents for the CMS/FS and schedule are provided in Appendix J.

The CMS/FS tasks include:

- Establish narrative corrective/remedial action objectives and, if appropriate, numeric remedial action goals
- Develop General Response Actions (GRAs) and identify potential remedial technologies and process options
- Screen potential remedial technologies and process options and develop a list of representative process options (RPOs)
- Assemble RPOs into remedial alternatives
- Screen remedial alternatives to eliminate unfeasible and impracticable options
- Further define alternatives as necessary
- Analyze alternatives against the nine evaluation criteria, then against each other
- Prepare the CMS/FS report to document results

The above list of tasks is adapted from EPA's *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA* (EPA, 1988a). At RFETS, the primary use of the CMS/FS process will be to evaluate the combined results of various accelerated actions. In that instance, based upon risk assessment and ARARs evaluations, the CMS/FS may result in narrative remedial action objectives and numeric remedial action goals that do not compel evaluation of a wide range of remedial technologies and process options.

The scope and content of the CMS/FS is not subject to an arbitrary formula. The evaluation of technologies and process options, and subsequent screening and analysis is focused on the risk and ARARs-based remedial action objectives.

### 3.1.10. Technical Memoranda

TMs will be written, if necessary, to resolve specific interpretive issues. They will be brief, similar in nature to a "white paper," and will be focused on presentation and discussion of

information relevant to the specific issue. Many TMs will be developed to address or clarify issues, and will not be subject to the document review and revision process. When the TM modifies a previous decision document, the modifications must be accomplished consistent with Part 10 of RFCA and Section 3.10 of the IGD. The RFCA specifically identifies three types of TMs:

- BRA TM
- CMS/FS TM
- RFI/RI Work Description TM

Examples of other types of TMs would be: impact evaluations of exceedances of action levels, the examination of design data needs, an evaluation of the actual impact of an ARAR on an action, or compilation and discussion of data to determine whether a constituent above an ARAR or a RFCA ALF cleanup level is within natural background variability for the Site. TMs will be incorporated into the AR.

### **3.1.11 RCRA Closure**

RFCA Attachment 10 provides direction on closure of RCRA interim status units. This guidance can also be applied to permitted units, however, these are not covered by the agreement. Four significant RCRA closure issues are included in RFCA:

- Closure of permitted and interim status units incorporated into a decision document in lieu of a unit-specific closure plan
- Closure of land-based and non-land-based RCRA interim status units
- Clean closure of RCRA units
- Phased closure of RCRA units

Hazardous waste management units are subject to closure under the RCRA Part B Permit or the Interim Status Closure Plan. According to RFCA ¶97, CDPHE will determine if a separate closure plan is required or if the closure/post-closure requirements will be incorporated into a decision document. Closure of land-based interim-status units will be incorporated in IM/IRAs, non-land-based interim-status units may be covered by a PAM, an IM/IRA, or an RSOP. RCRA units not closed under accelerated actions or decommissioning will be closed as part of the final CAD/ROD (e.g., 750 and 904 pads).

All closures will be performed in accordance with the CPB. Wastes generated during a closure action, wastes from a corrective action for a land-based unit or residual wastes from a non-land-based unit, are considered remediation wastes. Existing contamination will be addressed separately, as part of RCRA corrective actions/CERCLA remedial actions as determined by the ALF and detailed in the *Groundwater Conceptual Plan for the Rocky Flats Environmental Technology Site* (RMRS, 1996b).

Section I of RFCA Attachment 10 enumerates the minimum requirements for closure of land-based interim-status units (the Solar Ponds and Present Landfill). This section specifies design criteria of a cap/cover over these land-based units, as well as monitoring and other post-closure activities.

Minimum closure requirements for non-land-based units (mostly former OU 9 IHSSs) are discussed in RFCA Attachment 10, Section II. This section specifies the removal of all wastes from these units and describes how the units can accomplish clean closure via corrective action based on an appropriate decision document. If a unit cannot achieve clean closure, other requirements, including post-closure requirements, will apply.

The RCRA Part B Permit (CDPHE, 1997) parallels RFCA §71 by specifically providing for phased closure when appropriate. Phased closure begins when a unit is placed in a "RCRA-stable" configuration. The RCRA-stable concept is not described in or regulated by RFCA, but it is included in Section E of Part X of RFETS's RCRA Part B permit. This strategy for clean closure allows DOE RFFO to conduct the closure of a permitted unit in two stages: first by rendering a unit/portion of a unit RCRA stable, followed by completion of the final stage of closure as part of a RFCA-regulated cleanup activity. Once a permitted unit is placed in a RCRA-stable configuration, final closure of the unit is deferred until it is scheduled pursuant to the RFCA budget planning process and prioritized and integrated with other activities. RCRA-stable units will be indicated as such, pending final closure, in the Master List of RCRA Hazardous Waste Units at Rocky Flats, which is updated semi-annually. Elements of this closure strategy include waste removal, elimination of future waste input, less stringent unit management practices (e.g., inspection requirements), and removal of the unit including disposition of associated equipment and debris.

### **3.1.12. Closeout Reports**

A Closeout Report will be prepared for all remedial or accelerated actions, including decommissioning remedial actions, when work and relevant final characterization is completed. The Closeout Report will consist of a brief description of the work that was completed, including (1) any modifications to the original decision document, (2) final sampling and analysis report(s), (3) a description of the quantity, characteristics, storage and disposal of the remediation and process waste produced, and (4) a statement, if true, that there were no releases to the environment due to the execution of the project or, if not true, a description of the release and the response taken.

The Closeout Report will state whether, as of the date of the Closeout Report, the goals and objectives of the action were met, and, if not, what additional work is required. The complexity of the Closeout Report and the level of detail will reflect the scope and duration of the action. An example outline for a Closeout Report is shown below (only topics germane to the action are required to be included in the report).

- Introduction
- Action description
- Verification that action goals were met
- Verification of treatment process
- Radiological analysis
- Demolition survey results
- Waste stream disposition
- Deviations from the decision document
- Description of site condition at the end of decommissioning (e g , slab, basement, etc )
- Site reclamation
- Demarcation of excavation
- Demarcation of wastes left in place
- Dates and duration of specific activities (approximate)
- Final disposition of wastes (actual or anticipated)
- Next steps for the area (e g , decommissioning is complete, facility demolished or ready for reuse, interim monitoring, if required, or ER action in progress or further evaluation required)

An ER closeout report will be prepared for all ER projects and will be submitted to the agencies. A decommissioning Closeout Report will be prepared for all building decommissioning projects. Only the decommissioning Closeout Reports for Types 2 and 3 (See Section 3.2) building decommissioning projects will be submitted to the agencies. The DPP requires that upon completion of the relevant final characterization (final status survey), DOE RFFO will notify CDPHE, EPA and the public in writing of the completion of decommissioning for a building or group of buildings. DOE RFFO will accomplish notification to the public with a letter to the Rocky Flats Citizen Advisory Board (RFCAB) with a copy of the Closeout Report transmittal letter, which is provided to the appropriate agencies. 3

### **3.1.13. Project Cost Summary**

Following project completion, DOE RFFO will provide the following "unburdened" general project costs to the agencies:

- Total project "burdened" and "unburdened" costs
- Project management
- Planning and site preparation
- Excavation and site restoration
- Treatment
- Transportation
- Waste disposal

The Project Cost Summary must be reviewed by K-H Legal prior to its release to the agencies to ensure the information is submitted in a manner to protect confidentiality

### **3.2. DECONTAMINATION AND DECOMMISSIONING**

The Decommissioning Program is governed by the DPP which describes how aspects of building decontamination and decommissioning will be implemented and elaborates on Attachment 9 of RFCA. The process described in the DPP begins with a scoping meeting, proceeds to reconnaissance level survey for contamination, a hazard assessment, and a reconnaissance level characterization report of the findings. At that point, the lead regulatory agency is notified of the categorization for concurrence. Figure 3.4.1 of the DPP provides an illustration of the process.

The DPP identifies three categories of buildings. Each category of building is subject to progressively more rigorous levels of regulatory scrutiny.

- Type 1 buildings are free of contamination.
- Type 2 buildings are "without significant contamination or hazards but in need of decontamination"
- Type 3 buildings have significant contamination and/or hazards. Buildings 371/374, 559, 707, 771/774, 776/777, and 779 have been designated as Type 3.

For Type 1 buildings, following the reconnaissance level survey, buildings determined to be free of contamination may go directly to reuse, dismantlement, or demolition. For Type 2 and Type 3 buildings the appropriate decision document must be prepared. Buildings may be reclassified from Type 1 to Type 2 if contamination is discovered and the removal techniques will involve a threat of release. Suggested outlines for the decommissioning decision documents are provided in the DPP.

Other documents may also provide useful guidance for completing decommissioning at RFETS. The Facility Disposition Program Manual provides broad information to facilitate projects. In addition, decommissioning characterization protocols have been developed and will assist in conducting reconnaissance level characterization, in-process characterization, and final status surveys.

### **3.3. INTEGRATION OF DECONTAMINATION AND DECOMMISSIONING AND ENVIRONMENTAL RESTORATION**

Prior to the initiation of decommissioning activities, monitoring efforts (monitoring for surface water, groundwater, and air) are required to establish the baseline conditions that exist in the Industrial Area. This effort is coordinated with the RFETS ER and

**Environmental Systems and Stewardships Organizations** To establish good baseline conditions, this effort should occur very early in the decommissioning scoping phase and to the extent practicable, be incorporated into the IMP update

The ER organization will be integrated into decommissioning project scoping to develop an understanding of the project, such as type of contaminants expected in the building, to decide whether adequate monitoring is in place to establish the baseline conditions, and to decide what part of the structure, if any, will be left at the end of decommissioning

One mechanism used to accomplish ER and D&D integration is the IMP. This plan is a comprehensive consensus-based monitoring plan that incorporates the current thinking of DOE and its contractors, the agencies and the stakeholders. It is intended to capture the required environmental monitoring needed to demonstrate environmental compliance during ongoing operations and closure activities. More recently, the plan has been revised to begin focussing on elements that provide necessary closure documentation. For example, the latest revision to the IMP will be addressing the use of more accurate analytical methods to determine background concentrations of uranium in the groundwater. Discussions have also begun to find ways to incorporate "generic" language that captures the decision rules and data requirements for characterization of soils and building rubble that may remain in the environment at the Site past closure.

### **3.4. DATA MANAGEMENT AND QUALITY ASSURANCE/QUALITY CONTROL**

#### **3.4.1 Data Management**

A variety of data will be generated during remediation and ER decommissioning. These data include but are not limited to

- Air monitoring data
- Meteorological data
- Ecological data
- Surface water monitoring data (including physical and chemical information)
- Groundwater monitoring data (including analytical and field parameters)
- Well construction data
- Geological characterization data
- Spatial data
- Waste characterization data
- Field screening data
- Soils data (analytical and physical data)
- Other characterization data (including high purity germanium [HPGe] field data)

As shown in Figure 3-7, RFCA project managers are responsible for defining their data needs and managing their data to produce current decision documents and the final CAD/ROD. The RFETS Closure Support Group will provide analytical data of known quality, deliver the data to customers, and store the data in RFETS electronic data systems for current and future use. The data collected during all cleanup activities are essential to the successful closure of the RFETS and development of the final CAD/ROD. Therefore, proper management of the data is a key responsibility of the project. In addition, RFETS is required to provide copies of electronic environmental data collected as part of the RFCA process to the agencies (CDPHE and EPA). Therefore, lack of appropriate management may impact the Site's ability to meet RFCA requirements. Appendix F provides details on closure data management requirements.

### **3.4.2 Data Quality**

The RFCA project manager must ensure that environmental data collected in support of RFCA activities meet all applicable data quality requirements (Appendix F), including

- Analytical data quality requirements
- Program data quality requirements, and
- Evaluation of the data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC). Details on the analytical data quality assessment process and PARCC analysis are provided in Appendix F.

Quality Assurance/Quality Control (QA/QC) requirements are addressed in a graded approach in accordance with DOE Order 5700 6C (DOE, 1996e) for non-nuclear facilities, activities and services and with the NCP (40 CFR Part 300). Specifically 40 CFR §300.415 (b)(4)(ii) for CERCLA removal actions and 40 CFR §300.430(b)(8) for CERCLA remedial actions require FSPs, SAPs, PAMs, IM/IRAs, RSOPs and Closeout Reports to address quality concerns. Additional details on QA/QC are provided in Appendices F and I.

### **3.5. ARARS AND RFCA PERMIT WAIVER**

RFCA requires a process be developed for identifying applicable or relevant and appropriate legal requirements for response actions under CERCLA. (See RFCA ¶10p). To accomplish this objective, an RFETS Master List of Potential ARARs (ARARs List) for actions that will be taken on-Site is included in the IGD Appendix K. ARARs identification will be initiated when individual projects are scoped, and ARARs will be determined when the decision document is approved. Interpretation of ARARs during a response action will be accomplished using the consultative process. Documentation of ARARs that could not be met during an accelerated action should be documented in the Closeout Report Section (3.1.12). Final ARARs for the Site will be documented in the appropriate CAD/ROD.

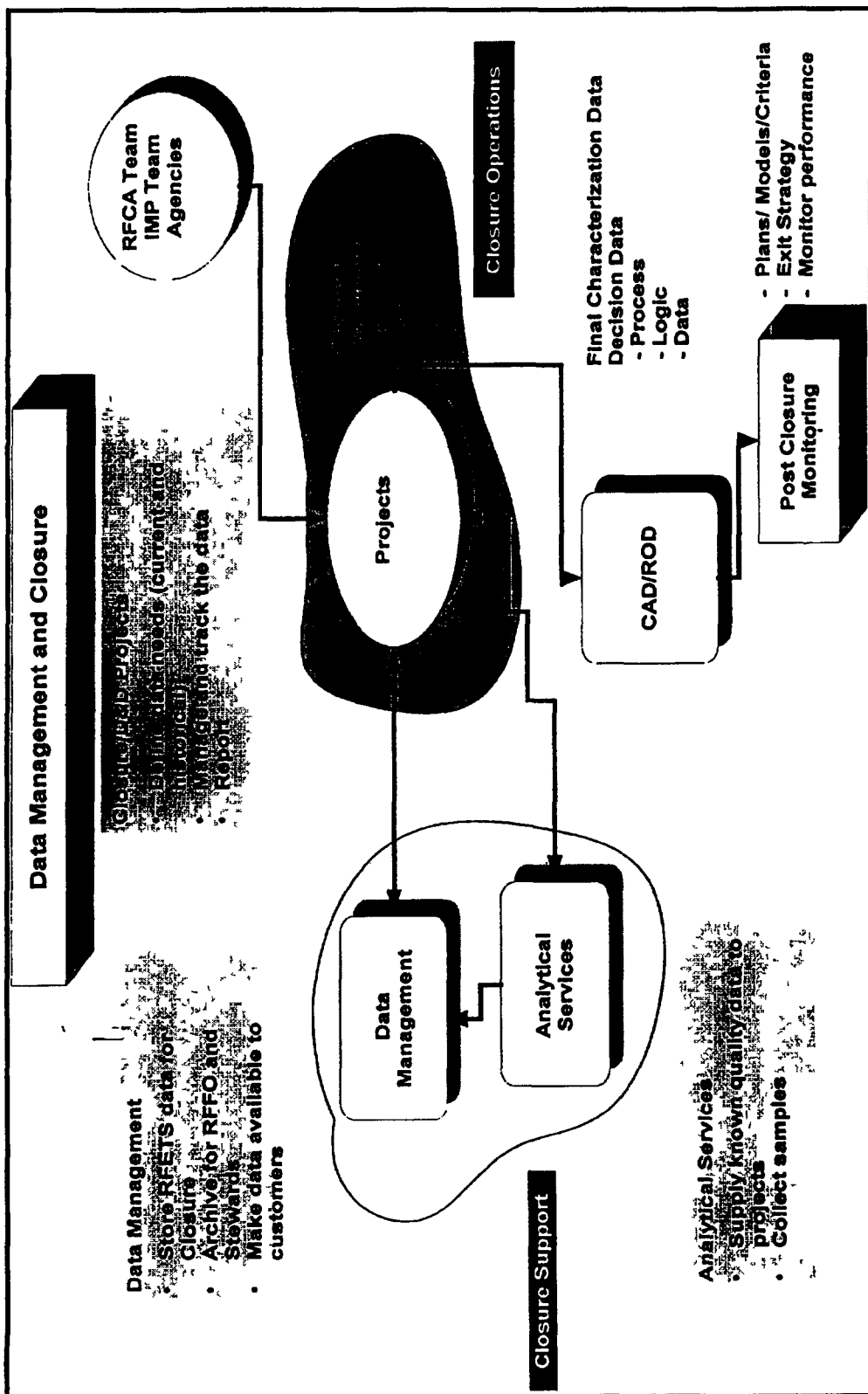


Figure 3-7 Environmental Data Management and Closure

### 3.5.1. ARARs List

The ARARs List (Appendix K) serves to narrow the universe of potential ARARs. Environmental requirements with little or no likelihood of applicability or relevance and appropriateness (e.g., Coastal Zone Management) have been removed from consideration. The ARARs List will be updated as needed, and at a minimum on an annual basis (See RFCA ¶5).

### 3.5.2. Project-Specific ARARs Analysis

ARARs will be initially identified when projects are first scoped. The identification will be conducted consistent with the NCP, the preambles to the proposed and final NCP, CERCLA Compliance with Other Laws Manuals Part I and Part II (EPA, 1988b and EPA, 1989b), and other EPA ARARs guidance.

The identification will begin by evaluating the ARARs List for applicability or relevance and appropriateness. Once the ARARs are narrowed, the final presentation and determination will occur in conjunction with approval of the decision document. ARARs interpretations during actions will be accomplished using the consultative process. Where documentation is warranted, TMs will be prepared.

### 3.5.3. Exemption from Administrative Requirements of ARARs

CERCLA and RFCA require compliance with substantive, not administrative, ARARs (See 40 CFR §300.5, definition of *Relevant and Appropriate Requirements*). EPA recognizes that, in some circumstances, the distinction between administrative and substantive requirements is not clear. To address this, EPA described the problem and factors to consider as follows:

*In most cases, the classification of a particular requirement as substantive or administrative will be clear, but some requirements may fall into a gray area between the provisions related primarily to program administration and those concerned primarily with environmental and human health goals. Several factors may be considered when it is not readily apparent whether a requirement is substantive or administrative, for example, the basic purpose of the requirement, any adverse effect on the ability of the actions to protect human health and the environment if the requirement were not met, the existence of other requirements (e.g., CERCLA procedures) at the site that would provide functionally equivalent compliance, and classification of similar or identical requirements as substantive or administrative in other situations. The determination of whether a requirement is substantive or administrative need not be documented.*

(See preamble to the proposed NCP, 53 FR 51443, middle column, center)

### 3.5.4 RFCA Permit Waiver

RFCA ¶16 provides a waiver from permitting for response activities conducted entirely on the Site. The response activities eligible for the permit waiver include

- Removal or remedial actions in the Buffer Zone
- Decommissioning activities
- Activities under any concurrence CAD/ROD
- Remedial actions in the Industrial Area for hazardous substances that are not also hazardous wastes or hazardous constituents (e.g., radionuclides that are not mixed wastes and PCBs)

In order to receive a permit waiver, DOE RFFO must include in the decision document

- An identification of each permit that will be exempt
- An identification of the standards, requirements, criteria, or limitations that would have had to have been met to obtain the permit
- An explanation of how the response action proposed will meet the standards, requirements, criteria, or limitations otherwise required by the permit

### 3.6 RISK EVALUATION

The evaluation of human health and ecological risk is central to the implementation of RFCA. ¶B2a of the RFCA preamble states that controlling the sources of contamination will be the priority of the ER Program. Unacceptable risk will be reduced by remediation or management actions. Risk reduction is best achieved through the risk assessment process.

Under the authority of CERCLA, the EPA has developed guidelines for the evaluation of human health and ecological risks and hazards (EPA, 1994b). Site-specific guidance and parameters to be used in risk evaluations have been negotiated with DOE, EPA, and CDPHE (DOE 1995b, 1995d, 1995e, Appendix L). The Site-specific guidance and parameters have been used and approved in a series of OU-specific BRAs (DOE 1995f, 1995g, 1996c, 1996d). This section documents agreed upon risk methods and parameters, and the points at which they may be applied in the risk management process defined by RFCA and the ALF.

The ALF defines action levels as "numeric levels that when exceeded, trigger an evaluation, remedial action, and/or management action." Since action levels are derived from risk calculations (or, in the case of radionuclides, dose calculations which are within risk limits), comparisons to action levels constitute a risk evaluation. Management decisions and remedial actions should be based on a detailed knowledge of the risks to human health and

the environment. The Site-specific Human Health Risk Assessment Methodology (HHRAM) (DOE, 1995b) coupled with the Ecological Risk Assessment Methodology (ERAM) (DOE 1996a, 1996b) provide the necessary tools. These methodologies are discussed in more detail in Appendix L.

### **3.6.1. Implementation of Risk Assessment Methodologies Within the RFCA Framework**

When an action level for surface soil or subsurface soil is exceeded using single data point comparisons to action levels, the AOC is placed in the ER Ranking System and risk management options are evaluated. The sequence to be followed for action level comparisons is detailed in Section 3.7. Once it is determined that an action level is exceeded, further risk evaluation may be needed depending upon the complexity of the site under consideration.

Action levels for non-radiological chemicals are predominantly risk-based, except for organics in subsurface soils, which are calculated to be protective of surface water standards via groundwater transport. Action levels for radionuclides in groundwater and surface water are risk-based. Action levels for radionuclides in soils are dose-based. In accordance with ALF, chemical risk is considered to be additive when multiple chemicals are present, and radiological dose is additive when multiple radionuclides are present. The method for applying action levels when multiple contaminants are present is explained in Section 3.7.

The project manager must be sure decisions are made using cumulative risk when multiple contaminants are present at a site. After aggregated data are compared to action levels (see Section 3.7), a simple screening level risk assessment, using appropriate receptors and exposure factors, may be used to ensure remedial action decisions have a firm risk-based component. A situation in which a risk screen would be appropriate would be when the results of the action level comparison are very close to breakpoints.

To perform the screening level assessment, the AOC is chosen and the data are aggregated by the methods agreed to for the site-specific HHRAM. The potential contaminants of concern (COCs) can be chosen using a simplified background comparison (see Appendix L), and the exposure concentration calculated using the 95 percent upper confidence limit (UCL95) on the arithmetic mean concentration of contaminants within the AOC. If the estimated risks are below  $1 \times 10^{-6}$  and the hazard index less than one, the AOC may be recommended for NFA. If the risk is greater than or near  $1 \times 10^{-4}$ , an accelerated action may be necessary. If the risk between  $1 \times 10^{-6}$  and  $1 \times 10^{-4}$ , then a more detailed risk evaluation is warranted to ensure that an appropriate risk management decision is made. This detailed evaluation may be deferred to the CRA rather than generating multiple risk evaluations. Results of the screening level risk assessment should be reported in a condensed format (e.g., a letter report or TM).

### 3.6.2 Environmental Restoration Ranking

ER projects are prioritized based on an approved methodology for producing a risk-based ranking authorized in RFCA ¶74 (See Section 3.7 and Appendix L). Areas may also be added to the ranking as information from action level comparisons or risk assessments become available.

### 3.6.3. Comprehensive Risk Assessment

Part 8 of the RFCA states that after all accelerated actions have been completed, Site conditions, including residual risk from accelerated actions, will be evaluated and corrective/remedial action decisions will be rendered as appropriate. The preamble to the NCP discusses risk in the remedy selection process in 40 CFR 300.430(e). The preamble at 55 FR 8712 states, "*EPA selects remedies resulting in cumulative risks that fall within a range of  $10^{-4}$  to  $10^{-6}$* ". OSWER Directive 9355.0-30 (EPA, 1991) more specifically states that, "*(f)or sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than  $10^{-4}$ , action is generally not warranted*". These statements are consistent with the agencies' position that a CRA must be completed, including an evaluation of the contribution of all sources of risks and hazards to off-site receptors, before a final CAD/ROD for the Industrial Area and Buffer Zone can be accepted.

The protectiveness of the final remedy to human health and the environment must be measured by evaluating the cumulative risk for the entire Site. The CRA is the mechanism that can provide the answers needed for closure of the Site. The two alternative approaches that could be chosen for performance of the CRA are outlined below.

1. The CRA may be undertaken concurrent with remediation activities in the Buffer Zone and the Industrial Area. Performed in this manner, the CRA would be a living document and updated as remediation progresses. It would be used for directing resources toward remediation targets to reduce the cumulative risk to an acceptable level. The CRA would be a management tool to expedite closure and reduce unnecessary remedial activities.
2. The CRA could be performed after all building disposition, waste removal, and remediation have taken place. Performed in this manner, the CRA would only be used for the final CAD/ROD to ensure no cumulative residual risks from RFETS to human health or the environment.

The methodology for performing the RFETS Site-wide risk assessment has not been finalized. It has not been determined if the CRA will be completed as two modules, one for the Buffer Zone and one for the Industrial Area, or if it will be performed for the entire Site at one time. If a modular approach is used, care must be taken that the modules can be combined for the final estimates of risk to appropriate on-site receptors, environmental hazard, and for modeling of effects to groundwater, surface water, and off-site receptors. The

RFETS HHRAM will be used as the starting point for developing an appropriate methodology for the CRA. The exposure scenarios and factors previously agreed upon will also be used. The RFCA parties must decide the procedure for data aggregation and determination of how AOCs will be combined for evaluation.

### **3.6.4. Radiological Dose Evaluations**

Radiological dose evaluations of residual radioactive materials are required to ensure protection of public health under DOE Order 5400.5 (DOE, 1990) and to implement DOE's "as low as reasonably achievable" (ALARA) policy. DOE RFFO, EPA and CDPHE have agreed to use EPA's draft *Radiation Site Cleanup Regulations* (EPA, 1996c) for calculation of radionuclide action levels in soils. To be consistent with the RFCA and the ALF, all dose calculations will be done using RESRAD, the computer code the Argonne National Laboratory developed for DOE RFFO to facilitate the implementation of residual radioactive materials guidelines, and Site-specific exposure scenarios, exposure factors, and environmental parameters. A detailed explanation of the derivation of radionuclide action levels for soils is provided in the Action Levels for Radionuclides in Soils (Appendix M).

### **3.6.5. Cumulative Effects between Dose and Risk**

Action levels for non-radionuclide chemicals are risk-based, and chemical risk is considered additive when multiple chemicals are present. Radionuclide action levels are dose-based and radiation dose is considered additive when multiple radionuclides are present. Radionuclides and non-radionuclides will be assessed independently on a project-specific basis using methodology that is protective of human health and the environment. The RFCA Parties will consult regarding whether it is appropriate to assess the cumulative effects of radionuclides and non-radionuclide chemicals on a project-specific basis if the chemical risk and radiation doses are near their respective Tier I action levels.

## **3.7. THE ACTION LEVELS AND STANDARDS FRAMEWORK**

### **3.7.1. ALF Background**

The goals of the ALF are to

- Provide a basis for future decision making
- Define the common expectations for all parties
- Incorporate land and water use control into Site cleanup

The purpose of the action level is to

- Trigger an evaluation, remedial action, or management action
- Serve as interim cleanup levels, when appropriate
- Provide "put-back" levels for interim soil removals

As defined in the ALF

*Action levels are numeric levels that, when exceeded, trigger an evaluation, remedial action, and/or management action. Final cleanup levels will be determined in the CAD/ROD. For interim remedial actions, interim cleanup levels will equal Tier 1 action levels unless some other ALF provision requires a greater level of cleanup (e.g., protection of surface water). A standard is an enforceable narrative and/or numeric restriction established by regulation and applied so as to protect one or more existing or potential future uses. Within this framework, standards are associated with surface water use classifications and applied at points of compliance (POCs). Standards are not being directly applied to groundwater or soils.*

The surface water standards are based on promulgated state surface water quality standards below the terminal ponds and are applied as action levels above the terminal ponds. The action levels for groundwater are based on the maximum contaminant levels (MCLs). For those chemical constituents without MCLs or standards, groundwater action levels are based on programmatic preliminary remediation goals (PPRGs). PPRGs are chemical-specific and medium-specific risk-based concentrations calculated for an exposure scenario (e.g., office worker, open space recreational user) using Site-specific exposure factors, standard toxicity factors, and a carcinogenic risk level of  $1 \times 10^{-6}$ , or a hazard index of 1 for non-carcinogenic compounds (See Appendix N for PPRG Tables).

The action levels for surface soils were developed to be protective of human exposure under the designated land use conditions. The PPRGs are used as action levels for all non-radionuclide chemicals. Action levels for radionuclides in surface soil are based on the 15/85 mrem per year dose limits, consistent with EPA's draft Radiation Site Cleanup Regulations, and DOE's proposed 10 CFR 834 (58 FR 16268).

Subsurface soil action levels for many organics were developed to be protective of groundwater using the EPA Soil Screening Guidance (EPA, 1996a, 1996b). For metals, radionuclides and other inorganics, the subsurface soil samples were set equal to surface soil action levels.

### **3.7 2. Application of the Action Levels to Trigger Interim Actions**

#### **Surface Water and Groundwater Monitoring**

The application of the ALF to surface water and groundwater monitoring is described in detail in the IMP. The application of ALF to the groundwater portion of the IMP is shown in

Figure 3-8

Appendix O provides a "process description" as the approach to integrate the goals and objectives of groundwater monitoring, hydrogeologic characterization, and remedial actions at RFETS. The intent of this "process description" is not to prescribe specific analyses that must be performed, but to present a general approach that defines how groundwater contamination at RFETS will be assessed and addressed. By developing an integrated process, the basis for decisions regarding the need for remediation and the evaluation of remediation performance should be consistent, and will effectively protect surface water and ecological resources.

The IMP is developed using the inputs of DOE RFFO and its contractors, the agencies, and the stakeholders, working together to reach consensus regarding the monitoring needs of all parties, both for regulatory purposes and for purposes of assuring appropriate execution of closure activities.

The IMP describes the routine Site-wide monitoring programs for surface water, groundwater, air, and ecology. Sampling locations, frequency, analyte suites, and reporting requirements are provided for each media. The IMP implements additional sampling if Tier II groundwater action levels are exceeded or if surface water action levels/standards are exceeded at POCs. These activities may be in the form of source investigations, requiring expended sampling of water, sediments and soils, or other interim measures such as soil stabilization to ascertain the effects of controls on large disperse contaminated areas whose impact on surface water is not well understood.

For those constituents for which background levels exceed the groundwater action levels, the defacto action level is the background mean plus two standard deviations. In that instance, more frequent sampling and remediation will not be triggered by exceeding the action level. Examples under discussion are uranium (all isotopes) and manganese. Background values are being developed using available data.

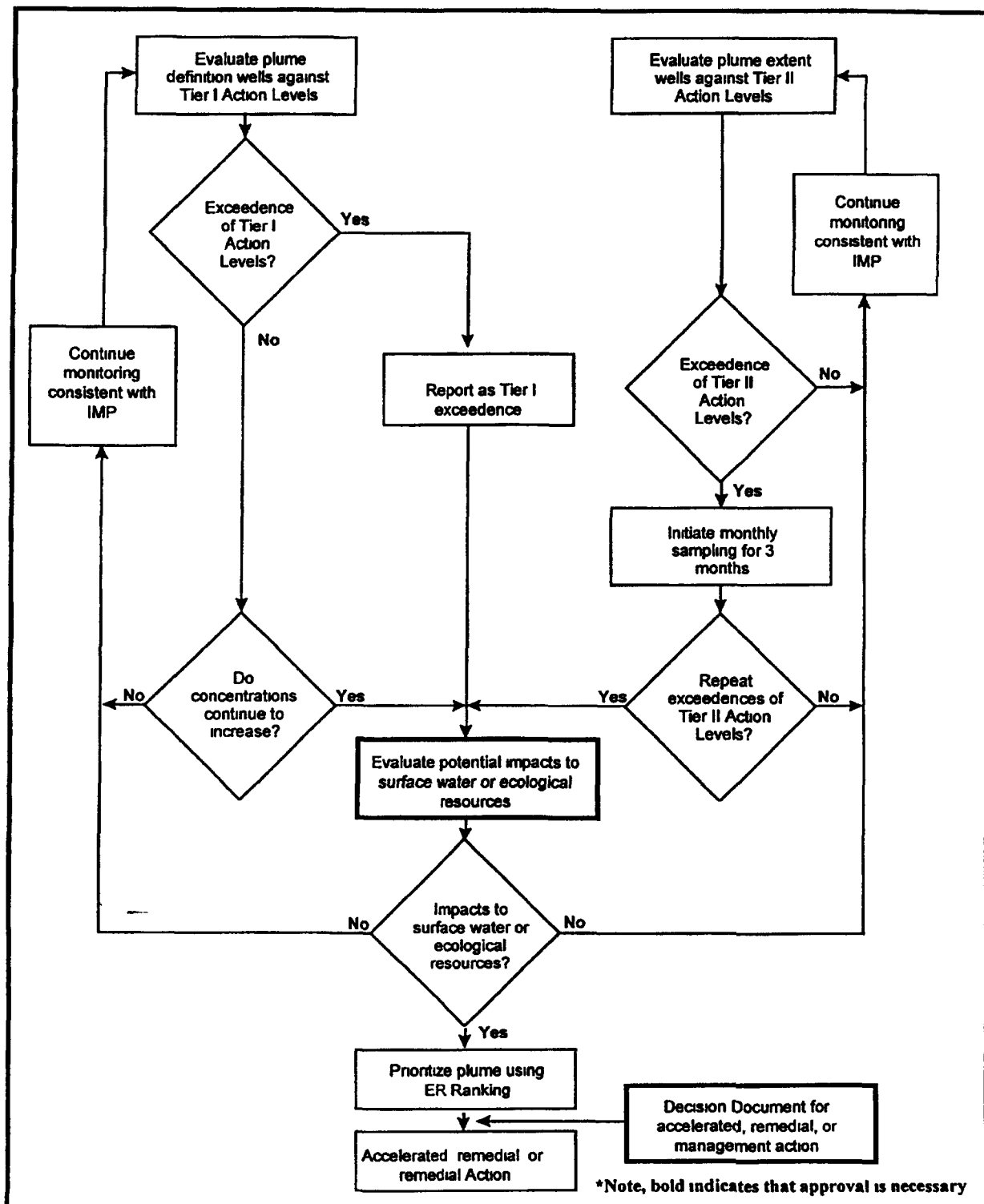
### Soil

The application of soil action levels to trigger interim actions requires a multi-step approach that includes soil data value comparison, determination of the AOC, aggregation of the data and comparison to the action levels, evaluation of options including additional characterization (as needed), and selection of management options. An overview of evaluation options available after the initial single data point comparison is shown in Figure 3-9, and summarized below.

#### Step 1: Soil Data Value Comparison

Compare single soil data values to soil action levels to determine

- Tier I exceedance



**Figure 3-8 Application of Groundwater Action Levels Through the Integrated Monitoring Plan**

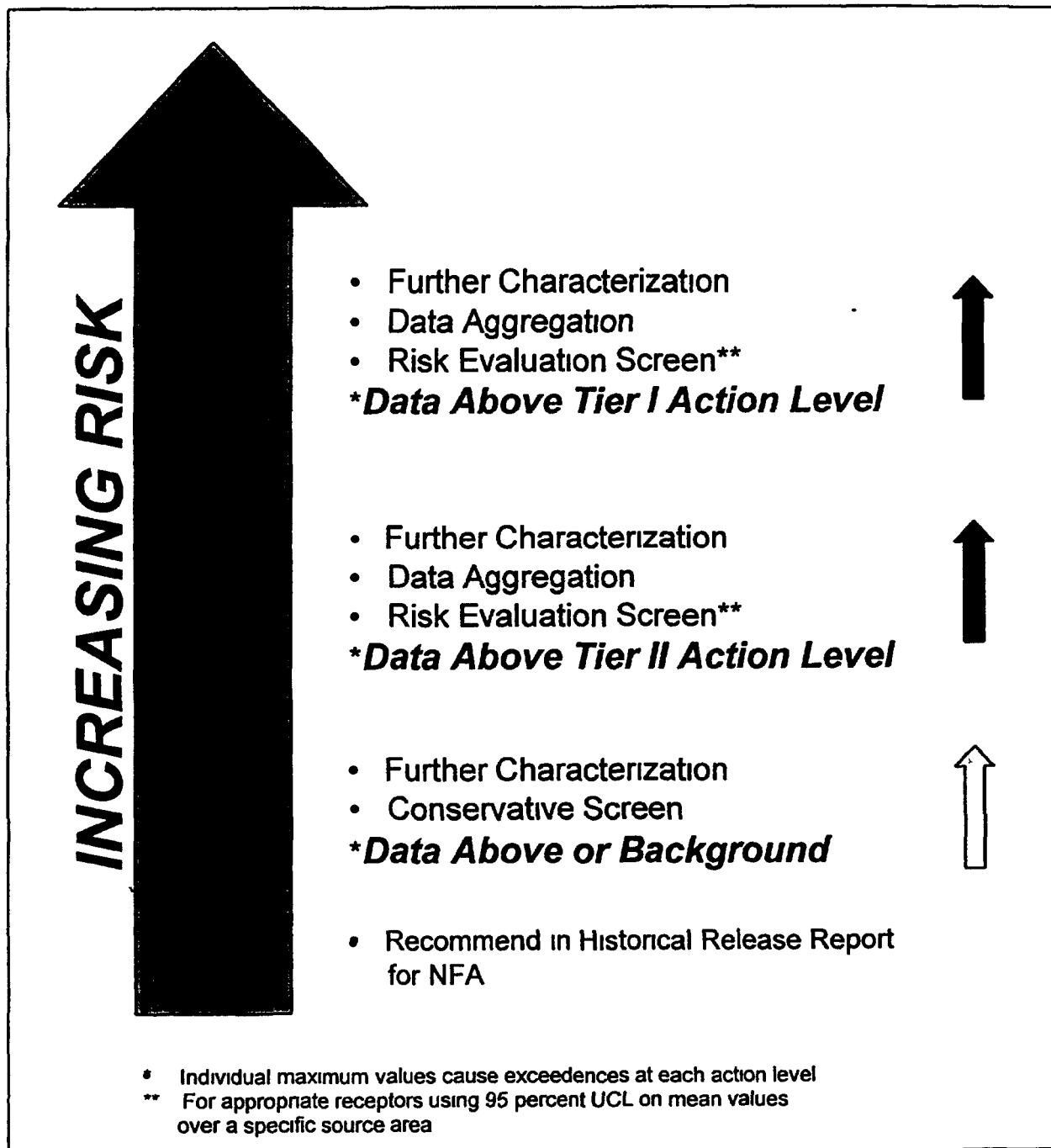


Figure 3-9 Evaluation Options After Data Point Comparison

- The ratio of each soil data value to the Tier I action level is  $> 1$ , or
- The sum of the ratios for either non-radionuclides or radionuclides is  $> 1$
- Tier II exceedance
  - The ratio of each soil data value to the Tier II action level is  $> 1$ , or
  - The sum of the ratios for either non-radionuclides or radionuclides is  $> 1$
- Below Tier II and above background or conservative screen
  - The ratio of each soil data value to the Tier II action level is  $< 1$ , or
  - The sum of the ratios for either non-radionuclides or radionuclides is  $< 1$

### Step 2: Data Aggregation

The spacial extent of contamination must be known for a remedial action to be planned and undertaken. The AOC is determined for this purpose. When an evaluation of a Tier I exceedance shows an area of very limited extent (e.g., a "hot spot"), data aggregation may not be appropriate, and an action may be performed. The AOC is determined and the data aggregated as follows:

- Determine AOC with respect to action levels using comparison to
  - background mean plus 2 standard deviations for inorganics
  - detection limits for organics
  - AOCs will be established based on the spacial data distribution
  - There is no lower limit on the size of an AOC, but no single AOC will exceed 10 acres
- Average data over the AOC, as appropriate
- Use the UCL95 of the mean for comparison to the appropriate action level

### Step 3: Evaluation Options

Other evaluation options shown in Figure 3-9 include further characterization or a more detailed risk analysis. If the amount of data available for an AOC is limited, then further characterization may be required. If the result of the action level screen, after data aggregation, is near the breakpoint of, then a more detailed risk assessment may be performed to better define the appropriate action. If the results of the action level comparison are below Tier II, then it may be appropriate to apply the CDPHE conservative screen or another risk evaluation to allow a NFA decision that does not require institutional controls (Section 3.1.5).

### Step 4: Management Options

Various management options are available for AOCs depending on the outcome of the

action level evaluation and the media. These are detailed in RFCA Attachment 5. (A general discussion is presented in RFCA Attachment 5, Section 1.3, and action determinations for subsurface and surface soils are detailed in Section 4.3 and in Section 5.3, respectively.)

### **3.7.3. Performance Objectives**

As stated in RFCA, Attachment 5, interim cleanup levels for interim remedial actions will equal Tier I action levels unless a provision of ALF, such as protection of surface water, requires a lower remediation goal. Each project will define its specific remediation goals in the appropriate decision document.

## **3.8. ANNUAL REVIEWS AND UPDATES**

### **3.8.1. Annual Updates of the Environmental Restoration Ranking**

In accordance with RFCA Attachment 4, the ER Ranking will be updated annually, or more frequently if significant new information or updated action levels become available. If no cleanup or investigation activities occur within a fiscal year, the ranking will not be updated that year. With the consensus of all parties, the priority of any ER site can be changed before updating the list, if additional information indicates that this is required.

The original ER Ranking methodology was refined for the 1996 report to make it compatible with RFCA and ALF. Appendix P presents the general methodology for ranking ER sites including media-specific evaluations and chemical score tabulation. The methodology produces a prioritized list of ER sites, and includes both a list of sites that require more information and a list of sites awaiting final disposition.

The ER Ranking will no longer be the sole source for identifying the remedial action sequence. The RFCA Parties recognize that future remedial actions will be addressed based on opportunity and D&D schedules. This opportunistic approach will evaluate the accessibility of an area and what, if any, potential future impacts exist due to other remedial actions in the area. The opportunistic approach will be balanced against the ER Ranking, any time it is determined that an IHSS is impacting human health or the environment, such that immediate action is warranted, then action will be taken as soon as possible.

### **3.8.2. Annual Updates for the Historical Release Report**

The HRR is required by CERCLA §103(c) to describe the known, suspected or likely releases of hazardous substances from RFETS. Original authorization for the HRR was provided in Section I.B.5 of the IAG (DOE, 1991). The HRR, which was published in June 1992,

provided a complete listing of all known spills, releases, and/or incidents involving hazardous substances that had occurred since the inception of RFETS. Section I.B.3 of the IAG established the requirement for DOE RFFO to notify EPA and CDPHE of any newly-identified or suspected releases or threats of release at RFETS, which may threaten human health or the environment. HRR updates were initially required every three months, however, all three parties to the IAG have agreed that DOE RFFO can submit HRR updates annually. The first annual HRR update report was delivered on August 30, 1996.

The process for updating the HRR has been developed through negotiations and document reviews by DOE, EPA, and CDPHE. As shown in the example presented in Appendix Q, the document format includes a description of the release event, complete physical and chemical descriptions of the constituents released, validated analytical data, responses to the event, fate of the constituents released, action/no action recommendations; comments, and a reference section. If the HRR update entry serves as a NFA recommendation, it should also state the category of NFA being proposed and should specify which criteria from RFCA Attachment 6 justify NFA. Because NFA recommendations based on ALF comparisons require institutional controls, this condition should be started in the HRR entry.

Among other purposes, the HRR updates serve as a basis for approving soil disturbance permits, as an aid in making waste determinations, as an aid in deciding the appropriate level of personal protection equipment for work in an IHSS, tracking IHSS status (e.g., boundary changes), and communicating IHSS information (e.g., analytical information for waste determinations required by EPA and CDPHE). RFCA Attachment 6, No Action/No Further Action Decision Criteria for RFETS, expands the scope of the HRR updates to include information on geographic areas for which a NFA recommendation is warranted.

The NFA decisions recommended in the HRR updates are intended to be "place keepers." An IHSS can be placed on hold until an OU-wide administrative process (PP, CAD/ROD, RCRA Permit Modification, etc.) is initiated.

### **3.8.3. RFCA Annual Review**

RFCA ¶5 states that

*The Parties shall conduct an annual review of all applicable new and revised statutes and regulations and written policy and guidance to determine if an amendment pursuant to Part 19 (Amendment of Agreement) is necessary*

The RFCA Annual Review is completed by July 19 each year by reviewing Attachment 5 and the following major environmental laws, and associated regulations, written policy, and guidance.

- CERCLA

- RCRA
- TSCA
- CWA
- Clean Air Act (CAA)
- NEPA
- Ecology (e g , Endangered Species Act)
- Radiation
- Radioactive Waste
- Defense Authorization Acts and Appropriation Acts

Questions which should be addressed for each area during the review are

- Are there any new or revised statutes, regulations, written policy, or guidance
- Has the regulatory change been implemented at the Site
- Does the regulatory change need to be implemented
- Does the regulation change impact RFCA and is an amendment required

The annual review prescribed in RFCA paragraph 5 is sometimes referred to as the "Regulatory Review" In addition to the annual review prescribed in RFCA paragraph 5, the RFCA Parties committed to conducting an internal annual review of the radionuclide soil action levels (RSALS) Questions to be addressed on an annual basis include

- Is there new scientific information available that would impact the interim action levels
- Has a national soil action level been promulgated within the year? If yes, the parties commit to revisit RFETS interim action levels
- How were the interim action levels applied to the Site over the course of the year
- Have the remedies been effective

For more details, see the Responsiveness Summary for Soil Action Levels released on November 6, 1996

While not required by RFCA, the RFCA Project Coordinators invite the public to submit any new information relevant to the RFCA or RSALS for these reviews during a 30-day comment period A public meeting by the RFCA Project coordinators will be held if requested The results of the annual regulatory review and the annual RSAL review are combined and documented in a RFCA Annual Review report which is completed by the end of August

In addition to the regulatory annual review and the RSAL annual review, RFCA requires the following items also be reviewed on an annual basis

- IMP (¶267)
- Rocky Flats Sitewide Integrated Public Involvement Plan (RFSIPIP)

- (¶ 281 (g))
- ER Ranking (¶ 79)
- AR (¶ 284)
- Milestones (¶ 147)
- Target Activities (¶ 136)
- Summary Level Baseline (¶141)
- ALF (¶ 5)
- HRR (¶119(1))

An annual review commitment is discussed in the IWMP and the IGD

For more details on the annual review past processes, see the 1998 RFCA Regulatory/RSAL Annual Review Report

#### **3.8.4. RFCA Biennial Review**

RFCA ¶257 states that

*The parties shall assess the implementation of the Agreement every two years with the first assessment being conducted no later than the second anniversary date of the execution of this Agreement. In this assessment, the parties shall conduct a review of the substantive and procedural requirements for this Agreement, including but not limited to the regulatory approach set forth in Part 8, to determine what measures each Party will take to ensure effective implementation of this Agreement. Such measures may include reallocation of resources, internal reorganization, revised procedures for consultation or internal coordination, and additional training of appropriate staff*

The RFCA Biennial Review will be completed by the second anniversary date of the execution of RFCA (by July 19, 1998) and every two years thereafter. The Biennial review is accomplished by establishing a RFCA Party assessment team charged with evaluating the progress at the Site during the past two years. The assessment team may conduct interviews and/or file and document reviews of parties responsible for the implementation and progress of RFCA and parties who were involved with the initial negotiations of the agreement.

For more details on the biennial review past processes, see the 1998 RFCA Biennial Review Assessment Report

#### **3.9. DISPUTES**

Part 15 of the RFCA enumerates procedures for dispute resolution. RFCA directs the parties to attempt first to resolve disputes informally. Where the dispute cannot be informally

resolved, the RFCA directs the parties to raise the disputed issue quickly. The types of disputes identified in the RFCA include

- Disapproval of a proposed final document (RFCA ¶s 115, 188)
- Denial or partial grant of a change requested for a regulatory milestone (RFCA ¶s 169, 188)
- Stop work orders (RFCA ¶s 176, 188)
- Force majeure (RFCA ¶175)
- Permit waivers (RFCA ¶16)
- Proposed permit modifications (RFCA ¶s 22, 188)
- Accelerated Actions (RFCA ¶69)
- Decommissioning (RFCA ¶69)
- Determinations that conditions or activities constitute a release or threat of release (RFCA ¶69)
- CAMU (RFCA ¶82)
- Additional work required under CERCLA (RFCA ¶200)
- RFCA interpretation or implementation (RFCA ¶189)
- Amendments to RFCA (RFCA ¶190)
- IMP (RFCA ¶188)
- Imposition of fees by CDPHE (RFCA ¶188)

The RFCA also identifies five classes of disputes and specifies the procedures for each. The five classes of disputes include:

- Decisions by lead regulatory agencies
- Disputes regarding additional work required under CERCLA
- Disputes regarding budget and work planning
- EPA-State disputes regarding site-wide issues
- Disputes regarding overall direction of proposed work

More specifics may be included in the future based on the results of the RFCA Biennial review concerning timing of disputes and recognizing issues as a dispute

### **3.9.1. Disputes Regarding Decisions By Lead Regulatory Agencies**

The RFCA creates two organizations to perform dispute resolution. The Dispute Resolution Committee (DRC) consists of the following individuals

- CDPHE – Hazardous Waste and Materials Management Division Director
- DOE – Assistant Manager for Environmental Compliance, RFFO
- EPA – Region VIII Assistant Regional Administrator for Ecosystems Protection and Remediation

The DRC is the first level of formal dispute resolution. The second level of dispute resolution is the Senior Executive Committee (SEC). The SEC consists of the following individuals:

- CDPHE – Director, Office of Environment
- EPA – Assistant Regional Administrator
- DOE – Manager, RFFO

The SEC receives disputes that the DRC has unanimously elevated without resolution or disputes that the DRC has resolved but are under appeal. A schematic of the process is provided in Figure 3-10.

### **3.9.2. Disputes Regarding Additional Work Required Under CERCLA**

Disputes regarding additional work required under CERCLA follow the basic procedures outlined in Figure 3-10. Authority to review appeals of SEC decisions is controlled by RFCA ¶69.

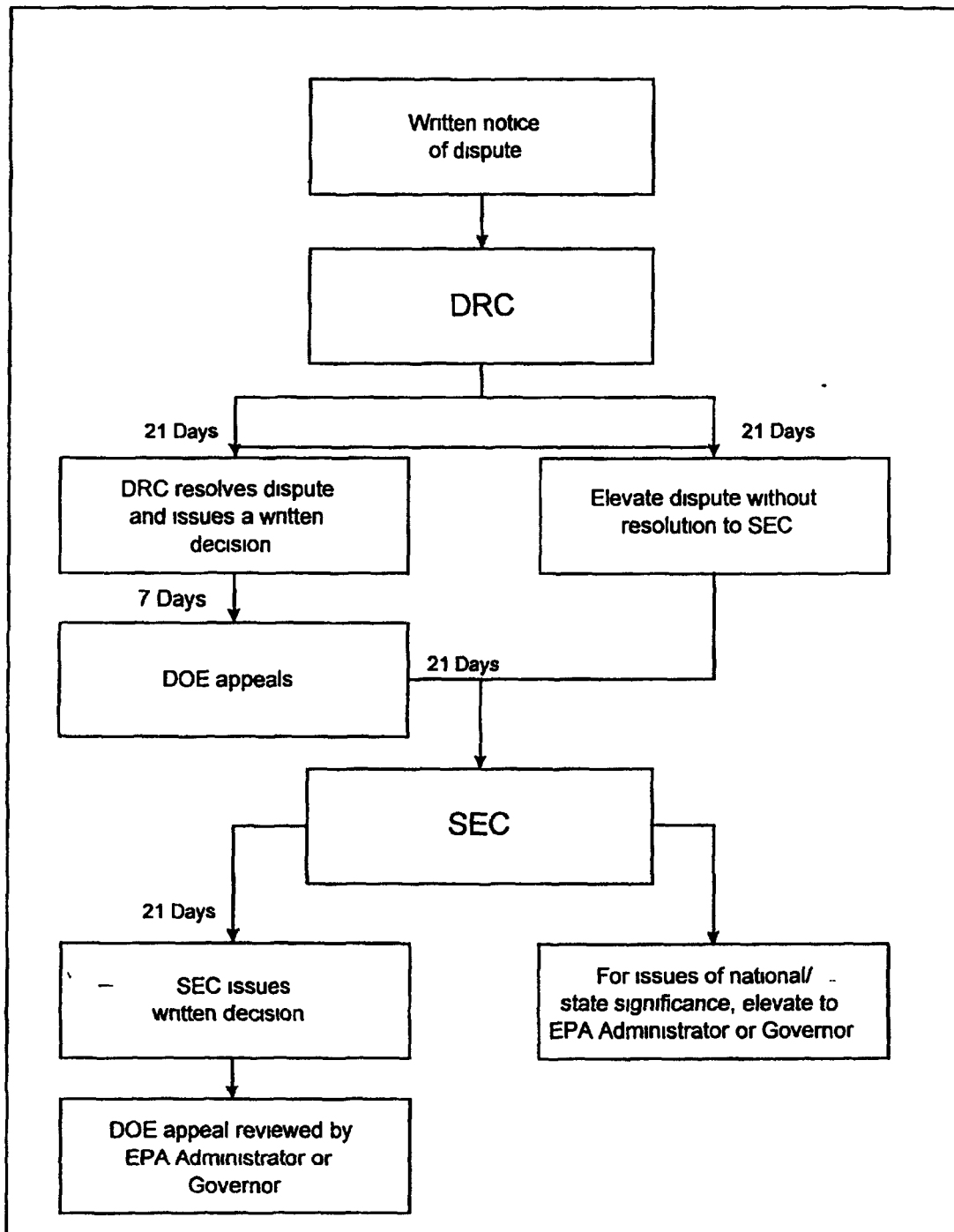
### **3.9.3. Disputes Regarding Budget and Work Planning**

DOE disputes regarding budget and work planning employ the procedures diagrammed in Figure 3-11.

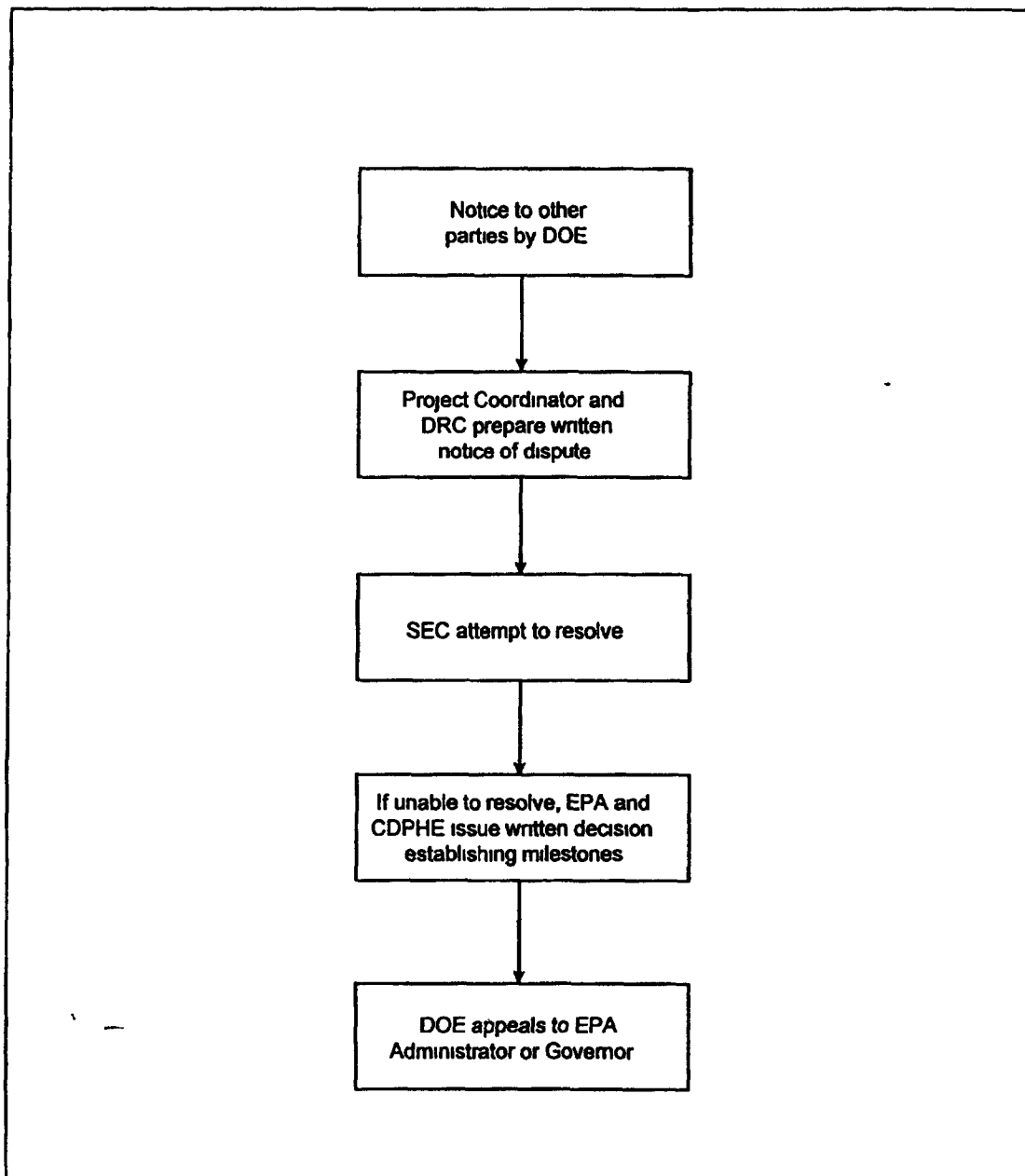
### **3.9.4. EPA–State Disputes Regarding Site-wide Issues**

For purposes of EPA–State disputes regarding Site-wide issues, the State-EPA Dispute Resolution Committee (SEDRC) and the State-EPA Senior Executive Committee (SESEC) have the same composition as the DRC and SEC except the DOE does not vote on those committees. The RFCA identifies the following as Site-wide issues:

- PP/draft permit modifications
- CADs/RODs
- Updates to the ER Ranking
- Updates to the IGD
- Future RSOPs for activities regulated under this agreement that are related to more than one OU



**Figure 3-10 Process for Disputes Regarding Decisions by the Lead Regulatory Agency**



**Figure 3-11 Disputes Regarding Budget and Work Planning**

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- Treatment systems that will treat wastes from the Industrial Area and the Buffer Zone
- Treatability study reports for activities that are related to more than one OU
- IMP
- Updates to the RFSIPIP
- Updates to the HRR

For a complete listing of Site-wide issues see ¶207 of RFCA DOE RFFO disputes regarding Site-wide issues employ the procedures diagrammed in Figure 3-12

### **3.9.5. Disputes Regarding Overall Direction of Proposed Work**

If one of the project coordinators is unable to concur with the overall direction of proposed work, dispute resolution follows the procedures outlined in Section 3.9.1 with minor changes (See RFCA ¶214)

## **3.10. MODIFICATION OF DECISION DOCUMENTS**

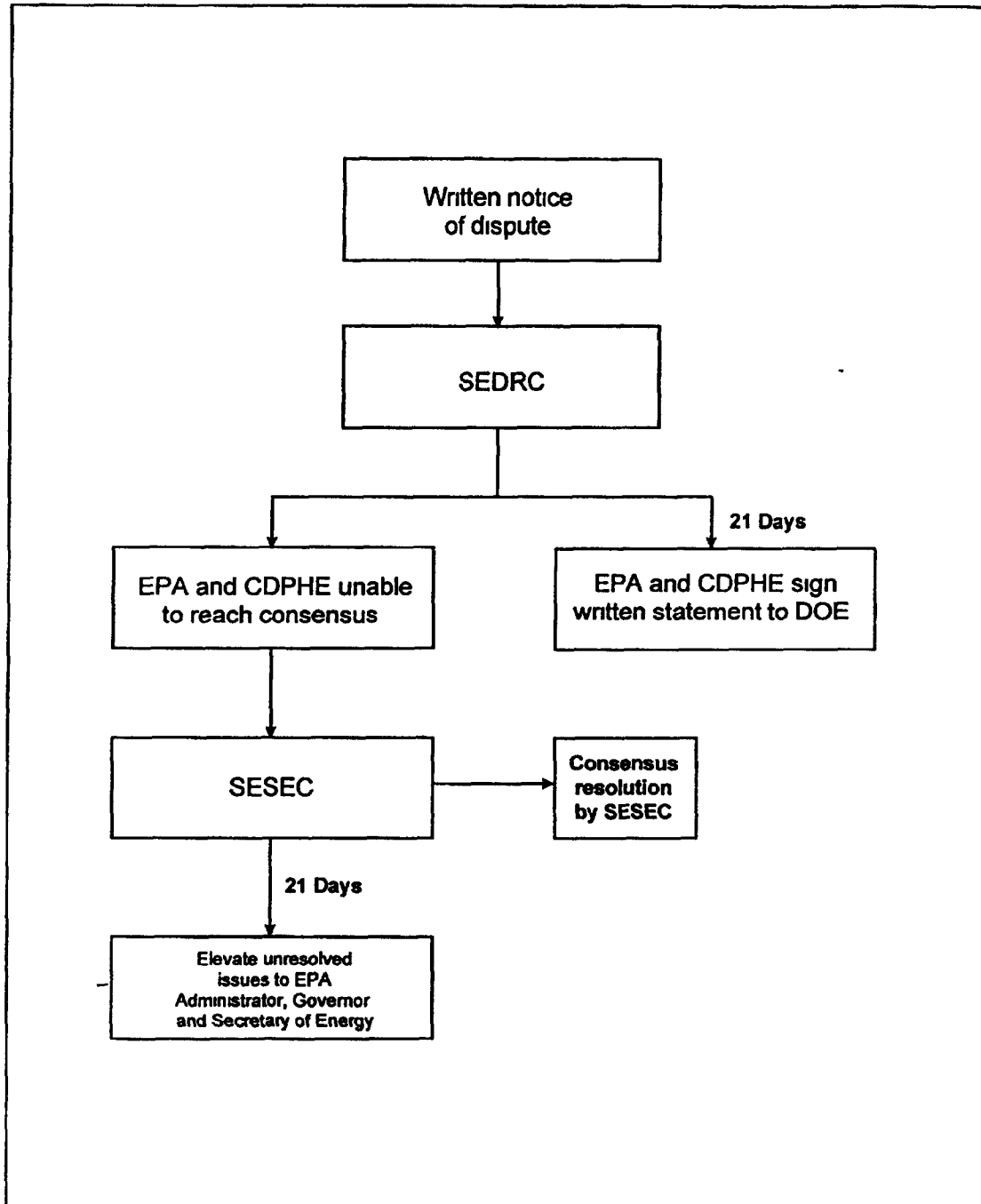
RFCA identifies three types of decision modifications: major modifications, minor modifications, and field modifications. Each type of modification is discussed in the following sections:

### **3.10.1. Major Modifications**

Major modifications represent a significant departure from the approved decision document. RFCA defines major modifications as follows:

*[A] modification to work that constitutes a significant departure from the approved decision document or the basis by which a decision was previously made or approved, e.g., a change in a selected remedial technology, a technical impracticability determination or a significant change to the performance of Standard Operating Procedures (SOP) (e.g., a tank closure that results in closure in place versus removal) that fundamentally alters the pre-approved procedure (See RFCA ¶25ar)*

Major modifications to work being done pursuant to a CAD/ROD are accomplished by submitting a written request with justification not less than 90 days prior to executing the change. Concurrently, public notice will be provided followed by opportunity for a 30-day public comment period. Following the public comment, the LRA will, if appropriate, approve the change or deny it and provide a written explanation no longer than 30 days after the close of public comment.



**Figure 3-12 Process for EPA/CDPHE Disputes Regarding Site-wide Issues**

Major modifications to work being done pursuant to an IM/IRA are accomplished by submitting a written request with justification not less than 30 days prior to executing the change. The LRA will, if appropriate, approve the change or deny it within 21 days of receipt. For PAMs, the written request must be received no less than 14 days prior to executing the change, and the LRA will approve or deny the change within 7 days.

### **3.10.2. Minor Modifications**

Minor modifications are changes that achieve substantially the same level of performance using a different technique. In effect, the change does not affect the final result of the activity. The RFCA defines minor modification as follows:

*[A] modification that achieves a substantially equivalent level of protection of workers and the environment and does not constitute a significant departure from the approved decision document or the basis by which a decision was previously made or approved, but may alter techniques or procedures by which the work is completed, e.g., a change in an RSOP that does not change the final result of the activity (e.g., alteration to a tank closure procedure that still results in a clean closure), or a change in operation or capacity of a treatment system that does not cause the system to exceed an effluent limit (See RFCA ¶25as)*

Minor modifications to work being done pursuant to a PAM are accomplished by submitting a written notification with justification not less than 7 days prior to executing the change. Prior approval of a minor modification is not required. If the LRA disputes the appropriateness of a minor modification, a stop work order by the LRA must be issued within seven days of notification.

Minor modifications to work being done pursuant to an IM/IRA are accomplished by submitting a written request with justification not less than 21 days prior to executing the change. For an IM/IRA, the LRA will approve the change or deny it with an explanation in writing within seven days of receipt. In appropriate circumstances, the LRA may waive the 21-day waiting period.

### **3.10.3. Field Modifications**

A field modification is allowed when unanticipated conditions are encountered. Field modifications are permitted, without prior approval, to avoid an imminent threat to human health or safety of the environment, prevent undue delay, or where a cost-effective alternative approach to the safe and protective execution of work is identified. (See RFCA ¶25ag)

Field modifications require DOE RFFO project coordinators give verbal notice to the LRA within one day of making the modification and follow the verbal notice with a written justification within seven days. The LRA may issue a stop work order within seven days of the notification if the work is inadequate or defective, likely to have substantial adverse impacts on other response action selection or implementation processes, or likely to significantly affect cost, scope, or schedule and requires further evaluation.

### **3.11. NPL DELISTING**

The NPL delisting process begins upon approval and acceptance of the final CAD/ROD(s). The NPL deletion process is described in detail in the Close Out Procedures for National Priority List Sites, Interim Final (EPA, 1995a). For a NFA CAD/ROD at sites that have continued passive remediation or monitoring, the following requirements must be met prior to initiation of the NPL Site delisting process:

- Accelerated action close-out reports for all remedial actions (ER and D&D)
- CAD/ROD(s) approval

Subsequent to submittal of the above listed documents, the five step delisting process will be initiated:

- Prepare the Notice of Intent to Delete with EPA and State review and approval
- Publish the Notice of Intent to Delete in the Federal Register for public comment
- Publish the Notice of Availability for the Notice of Intent to Delete
- Publish the Notice of Deletion along with the comment responsiveness summary in the Federal Register
- Place the final information package in local information repositories

It is possible to partially delist those portions of the Site where NFAs or remedies involving institution controls have been implemented. Deletion of the Site from the NPL may occur before the cessation of operation and maintenance activities specified in the CAD/ROD. Additionally, five-year reviews may be required after delisting.

### **3.12. SOIL MANAGEMENT**

(Reserved)

### **3.13. WATER MANAGEMENT**

The site's procedure for the management of incidental waters, Control and Disposition of Incidental Waters (1-C91-EPR-SW 01 Rev 2), defines incidental waters to include any waters that may accumulate in excavation sites, pits, trenches or ditches, secondary containments or berms, process waste valve vaults, electrical vaults, steam pits and other utility pits and or telephone manholes. Incidental waters also include fire suppression system discharges and the natural collection of precipitation and stormwater runoff in excavation pits, trenches and depressions. The Control and Disposition of Incidental Waters procedure authorizes management of incidental waters using currently available water treatment systems. See Section 2.6.2 for a complete discussion of wastewater and incidental water management options and procedures.

### **3.14. INTEGRATED MONITORING PLAN**

RFCA Part 21 Sections 267 and 268 require the development of an IMP, which collects and reports the data required to ensure the protection of human health and the environment consistent with the Preamble, and which is compliant with RFCA, laws, and regulations, and the effective management of RFETS resources.

The IMP describes Site monitoring performed for a variety of legal, contractual, and operational purposes and states the agreed-upon types of monitoring, monitoring locations, sampling frequencies and purposes of monitoring to meet RFCA goals. In some instances, the IMP includes monitoring that is already required outside of RFCA. The IMP is designed to provide data to support operational and regulatory decisions, and address the following primary regulatory drivers:

- RCRA
- CERCLA
- CAA
- CWA
- Colorado Water Quality Control Commission standards
- Regulations governing natural resource (ecological) management
- Site-specific monitoring and cleanup agreements
- DOE Orders and technical guidance

The IMP Background Document provides additional information on the DQO decision process and the regulatory framework that drives many of the monitoring decisions at the Site, as well as QA/QC requirements. The IMP Background Document is not subject to enforcement under RFCA.

The monitoring program is designed to accomplish the following

- Detect and identify contaminants in the targeted environmental medium, and monitor their concentrations
- Identify contaminant sources, and monitor remediation efforts
- Delineate contaminant pathways
- Assess the effects of Site remediation and closure activities
- Protect groundwater from new sources of contamination
- Evaluate any impacts of contamination on surface water

The monitoring program reports exceedences of the ALF, which may lead to active management or remediation. Following implementation of such management/remedial actions, the IMP provides the framework to conduct performance monitoring in accordance with the applicable decision document.

RFCA also specifies that the IMP will be jointly reviewed annually "based on previous monitoring results, changed conditions, planned activities and public input." Changes to the IMP are subject to approval of EPA and CDPHE.

The prescribed monitoring is performed in four primary areas: groundwater, surface water, air, and ecological systems. A fifth medium, soil, interacts with each of the other media and is also discussed in the IMP, however, because soil is no longer routinely monitored, the discussion of soil mainly concerns project-specific sampling.

### **3.14.1. Surface Water Monitoring**

Surface water monitoring encompasses five areas:

- Site-wide water quality
- Quality of waters within the Industrial Area
- Quality of discharges from the Industrial Area
- Quality of water leaving the Site
- Off-site water quality

### **3.14.2. Air Quality Monitoring**

The air monitoring activities on the Site assist in protecting the public and the environment by detecting and assessing the impacts of Site operations on air quality at and near the Site, characterizing any airborne materials that may be introduced, and monitoring the meteorological conditions that influence the transport and dispersion of airborne materials.

### **3.14.3. Ecological Monitoring**

Ecological monitoring is designed to verify the effectiveness of wildlife protection in the Buffer Zone, including any special-concern species (i.e., threatened, endangered, candidate, proposed, state-listed, or other sensitive species). In addition to the terrestrial vegetation communities, the aquatic communities of the riparian channels and ponds at the Site are monitored for ecological health.

### **3.14.4 Groundwater Monitoring**

Most of the groundwater at the Site is hydraulically connected to surface water. The groundwater monitoring program is designed to accomplish the following:

- Detect and identify contaminants in groundwater and monitor their concentrations
- Identify contaminant sources and monitor remediation efforts
- Delineate contaminant pathways
- Assess the effects of Site remediation and closure activities
- Protect groundwater from new sources of contamination
- Evaluate any effects of contaminated groundwater on surface water

The main (COCs) are volatile organic compounds (VOCs), which originated from the site's historical chemical use and storage during its years of producing nuclear weapons components. Possible sources of contaminants that could affect groundwater include storage tanks, the process wastewater system, drains, sumps, historical storage areas, and spills. The monitoring scope is designed to be conducted before, during and after RFETS operations that may affect groundwater quality.

#### **4. ADMINISTRATION**

This section provides an overview of the following

- The federal budgeting process
- Requirements for budget planning and authorization
- Controlling a project
- Compilation of the AR
- Records management and document control
- Reporting requirements

Section 4.0 has been written in conjunction with RFCA and RFETS standard policies and practices that provide policy and procedural direction for the diverse administrative functions performed at RFETS. The referenced plans, procedures, and documents are intended to supplement the guidance and minimum requirements presented in this section.

##### **4.1. BUDGET PLANNING AND EXECUTION**

All RFETS budgeting is performed in accordance with approved RFETS budget planning, formulation, and execution procedures. A summary of the budget planning and execution process is provided on Figure 4-1, General Timeline for Budget, RFETS CPB, RFCA Milestones, and K-H Performance Measures.

Funding at RFETS is based on the Fiscal Year (FY) cycle. The federal FY starts on October 1 and ends on September 30 of the following year. The FY is designated by the calendar year in which it ends. At any given time, four FYs are under consideration.

- PY – Prior Year (the previous FY completed)
- FY (the current FY or the execution year)
- FY+1 (also called the budget year) – where Congress considers DOE's budget request
- FY+2 (the first planning year) – where RFETS activity requirements are identified
- FY+3 through FY+5 (and beyond for some activities) – where budget plans are developed

The budget process has three main phases: (1) executive budget formulation and transmittal, (2) Congressional action, and (3) budget execution and control. Each of these phases is discussed in the following sections.

Final RFCA IGD  
Appendix 3  
July 19, 1999

	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
<b>Federal Budget Process (Row A)</b>	DOE-HQ and OMB negotiate FY+1 budget based on DOE FY+2 submittal the previous spring (B-4)			DOE-HQ and OMB negotiate FY+1 budget based on DOE FY+2 submittal the previous spring (A-1)	President submits FY+1 budget to Congress (A-2)	Congressional appropriations hearings and negotiations with DOE and OMB						President signs FY+1 federal appropriations bills into law (A-4)			
<b>RFETS Budget/Planning (Row B)</b>		RFEO gets FY+2 planning budget call from HQ (B-1)	RFEO reviews and updates FY+2 budget including any additional work, and Ten Year Plan receives input from President's FY+1 budget submittal (A-2)		FY+2 budget and planning meetings with stakeholders and DOE-HQ document FY+2 revisions (B-3)	RFEO submits FY+2 budget to DOE-HQ (B-4)	RFEO gives Kaiser-Hill Program Execution Guidance for FY+1 (B-6)	RFEO finalizes FY+1 baseline budget (A-3)	RFEO sets FY+1 baseline budget, with input from DOE-HQ (A-4), final/ISB (C-4) (B-7)						
<b>Integrated Site-wide Baseline (Row C)</b>		RFEO and Kaiser Hill budget and planning staffs revise draft FY+1 and FY+2 ISB (same staffs are also developing FY+2 budget and Ten Year Plan materials in B-2)			Revised FY+1 +2 ISB mult. Scenarios (B-2 D-4, D-6)		Revised FY+1 +2 ISB mult. scenarios (B-2 D-4, D-6)	Final FY+1 FY+2 ISB by Aug 1 based on site budget (B-6) (C-3) (B-6) (C-4)							
<b>RFCA Milestones &amp; Target Activities (Row D)</b>			RFEO after consulting with Parties and CAB proposes FY+2 activities and relative priorities (D-1)	Parties agree or disagree on regulations set, FY+2 Milestones and Target Activities (D-2)	Dispute Resolution begins for disputed FY+2 Milestones and Target Activities (D-3)	EPA and CDPHE set FY+2 Milestones even if no consensus exists (D-4)	Re-evaluate current FY progress and adjust FY+1 +2 accordingly input from C-3 (D-5)	Informal DRC-level meeting to continue evaluating FY+1 +2 Milestones and Target Activities (D-6)	Final FY+1 +2 agreement input from final budget (B-7) (D-7)	FY budget allocation Parties consult on FY FY+1 Milestones and Target Activities (D-8)	Re-establish FY and FY+1 Milestones and Target Activities or begin Dispute Process (D-9)				
<b>Kaiser-Hill Performance Measures (Row E)</b>					1st cut at FY+1 PMs based on C-2 (E-1)	RFEO and K-H agree on selection criteria, scope (E-2)	2nd cut at FY+1 PMs based on C-3 (E-3)	Negotiate FY+1 PMs starting July 1 (E-4)	Final FY+1 PMs requires step B-7 (E-5)	Maintain FY Performance Measures (E-6)					
<b>Regulatory Agency Review (Row F)</b>		RFEO shares FY+2 budget call to Parties to CAB (B-1) (F-1)	RFEO shares FY+1 budget based on A-2 (F-2)		RFEO shares FY+1 budget CAB Parties on FY+1 impacts (F-3)			Parties evaluate current FY projects especially those critical to RFCA Milestones (F-4)	RFEO briefs Parties on FY allocations. Parties evaluate FY FY+1 projects. If no agreement is reached within 60 days after budget allocation, regulators set milestones and Parties begin Dispute Resolution Process (F-5)						

Figure 4-1 General Timeline for Budget, CPB, RFCA Milestones and K-H Performance Measures

#### **4.1.1. Executive Budget Formulation and Transmittal**

The budget formulation process begins at least 14 to 18 months before the budget request is transmitted to Congress by the President. DOE RFFO prepares its budget request based on the guidelines provided by the President through the Office of Management and Budget (OMB) and through DOE Headquarters (HQ) (See Figure 4-2).

The budget is developed in the context of a multi-year budget planning system that includes coverage of the current FY as well as the FYs beyond FY+1. In FY 1997, the planning process was expanded to include coverage of all project years required to complete the RFETS mission and is not limited to four FYs. The system requires that broad budgetary goals, agency spending, and employment targets be established beyond the budget year.

During the formulation of the budget, there is a continual exchange of information, proposals, evaluations, and policy decisions among DOE RFFO, DOE HQ, OMB, and the President. Decisions concerning the upcoming budget are influenced by the results of budget validation reviews, previously enacted budgets (including the one being executed by the agencies), and the reactions to the last proposed budget under consideration by Congress. In accordance with current law, the President submits final agency budget requests to Congress no later than the first Monday in February.

#### **4.1.2. Congressional Action**

Between February and September 30, Congress is considering all federal agency budget requests. If Congress does not complete its work before the start of the FY (October 1), then a Continuing Resolution (CR) may be enacted for a given amount of time to keep agencies operating at the same level as the prior FY. During a CR, no new projects or activities may be started.

At any time, Congress can change funding levels, eliminate programs, enact legislation that authorizes an agency to carry out a program, or add programs not requested by the President or an agency. After the appropriation process, the program may be realigned through a reprogramming request. Both actions require OMB and Congressional approval.

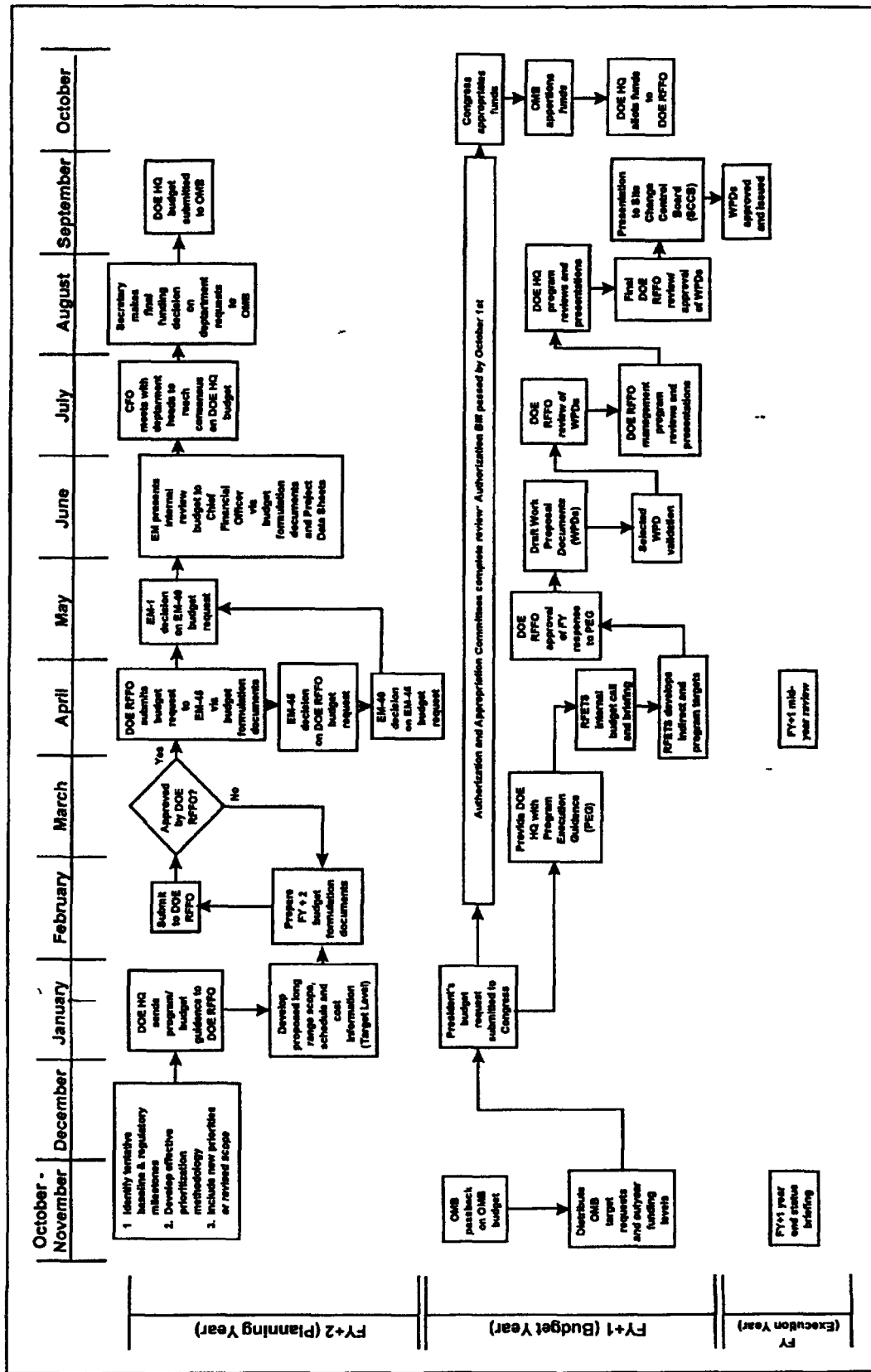


Figure 4-2 The Federal (DOE) Budget Execution Process

#### **4.1.3. Budget Execution and Control**

Once approved, the President's budget, as modified by Congress, becomes the basis of the financial plan for the operations of each agency during the FY. The sequence is as follows:

- The Director of OMB apportions appropriation (funding) to DOE HQ by time periods and by activities
- DOE HQ allocates funds to the various sites across the DOE complex, which include RFFO

For the remainder of the FY, DOE RFFO budget execution focuses on monitoring the site contractor's progress in performing RFETS cost baseline activities.

#### **4.2. PROJECT PLANNING AND BUDGET PROCESS**

To accomplish work at RFETS, the internal authorization basis process is closely coupled with RFETS CPB, and the provisions of the RFCA provide the planning and scope for achieving the RFETS Vision:

- To achieve accelerated cleanup and closure of RFETS in a safe, environmentally protective manner and in compliance with applicable state and federal environmental laws
- To ensure the RFETS does not pose an unacceptable risk to the citizens of Colorado or to the site's workers from either contamination or an accident
- To work toward the disposition of contamination, wastes, buildings, facilities and infrastructure from RFETS consistent with community preferences and national goals

##### **4.2.1. Project Planning/Project Scoping**

The RFETS system incorporates methods and procedures for planning, authorizing, and controlling a project so that work can be performed to defined specifications, schedule, and budget. The system defines the processes for:

- Organizing and defining work
- Assigning, planning, and authorizing work

- Measuring work performed
- Analyzing and reporting costs of work performed
- Controlling changes to an established baseline by use of a Site Change Control Board

All RFETS project planning is done in accordance with approved site procedures

### Scope

The project scope formally establishes the project mission, functional objectives, scope of work, technical approach, regulatory requirements, and assumptions. Project scope is determined by the project mission needs, objectives, and regulatory requirements. Project scope is outlined in a Project Baseline Description (PBD).

### Schedules

The critical path method of scheduling is used for establishing schedule baselines. Total life-cycle of a project is scheduled, however, near-term work may be in greater detail than out year work. Ongoing coordination between EPA, CDPHE, and DOE RFFO will occur to determine the appropriate target dates for intermediate milestones for multi-year projects.

### Closure Project Baseline

All work performed by DOE at RFETS will be scheduled and integrated by inclusion in a controlled master resource-loaded critical path method schedule, referred to as the CPB, that will include the life-cycle schedule of all the work scope required to achieve the RFCA Vision. Schedule detail will reflect a "Rolling Wave" method of scheduling, which produces a decreasing level of detail as time is extended from the current FY. The CPB will be used to direct and manage the RFETS work efforts while being the basis for current year and out year budgeting and planning. All scheduled reports, both internal and external (DOE, EPA, CDPHE, stakeholders, etc.) will be produced from the CPB. Individual schedules not incorporated into the CPB will not be recognized.

The CPB is the basis against which planning and project performance will be evaluated. A cost- and resource-loaded schedule allows the evaluation of planning alternatives as they relate to funding and resource constraints, while insuring the plan maintains the logical sequence of activity execution as the plan proceeds through multiple iterations. The CPB will also be used to manage the project and evaluate performance in prior and current fiscal years. The current working schedule and budgets will be updated using actual costs and schedule status to be compared to the baseline in the calculation of cost and schedule variances.

RFETS has developed a CPB that describes activities necessary to achieve the end of the Intermediate Site Condition as defined in the RFCA Preamble. The CPB reflects planning assumptions that are agreed to by DOE RFFO, EPA, and CDPHE. Changes to the project baseline that could lead to delays of important milestone completion dates will be approved by

DOE, EPA, and CDPHE as defined in RFCA The CPB shall be reviewed monthly and updated as required, and annually at a minimum

### **Closure Project Schedule**

The Closing Project Schedule (CPS) is a schedule depicting activities necessary to achieve the end of the Intermediate Site Condition This schedule will reflect data found in the CPB The Expanded Management Summary Schedule is a summary representation of the CPS

### **RFCA Change Control**

The RFCA change control process is the mechanism used by DOE RFFO, EPA, or CDPHE to assure that scope, schedule, or cost changes are reviewed for need, justification, and impact in a structured manner, and to assure that all parties can fulfill their responsibilities This process is defined in the RFCA, Part 10 (Changes to Work) If the change will affect regulatory milestones, DOE RFFO will identify proposed modifications to the regulatory milestones in accordance with RFCA, Part 12 (Changes to Regulatory Milestones) and notify the other parties of modifications to the baseline

### **Milestones**

EPA and CDPHE will establish milestones from the CPB, no more than 12 milestones per FY for FY, FY+1, and FY+2. Milestones will be designed to

- Provide accountability for key commitments
- Ensure adequate progress at the site
- Provide adequate scope drivers
- Facilitate budget planning and execution

EPA and CDPHE may also establish a few key out year milestones (i.e., beyond FY+2) to provide long-term drivers for achieving the end of the RFCA Intermediate Site Condition (See RFCA preamble for description)

### **Regulatory Milestone Change Control Process**

A regulatory milestone that is established according to the provisions of RFCA shall be changed upon receipt of a timely request for change, provided good cause exists Requests for change shall be submitted no less than 30 days before the date of the regulatory milestone except for changes sought on the basis of a force majeure Consistent with ¶165 of RFCA, any request for change shall be submitted in writing and shall specify

- The regulatory milestone that is sought to be changed
- The length of the change sought
- Good cause(s) for the change
- Any related regulatory milestone or target date that would be affected

if the change were granted

#### **4.3. REGULATOR INTERACTION IN THE BUDGET AND PLANNING PROCESS**

This section provides an overview of regulatory participation in the RFETS budget and planning process for FY, FY+1, and FY+2. Refer to Part 11, Subpart A, ¶s 133-149 of the RFCA for detailed information regarding these interface points.

##### **4.3.1. FY Activities**

FY activities are those that occur during the current FY. These activities are as follows:

###### **April through May**

Within 30 days following the completion of DOE annual mid-year management review, DOE RFFO will brief EPA and CDPHE on any decisions that affect the CPB and RFCA regulatory milestones.

###### **July through September**

DOE, EPA, and CDPHE will evaluate the current schedule, cost and funding status of all projects in progress in the just-ending fiscal year, particularly those activities or projects that are on the critical path to meet regulatory milestones in the upcoming two fiscal years.

In addition, the DOE, CDPHE, and EPA RFCA Project Coordinators will meet periodically through the FY to monitor and discuss the status of projects scheduled during the year. DOE RFFO will promptly notify EPA and CDPHE of any proposed site-specific or programmatic action, if such action may have an impact on DOE's ability to meet the baselines or regulatory milestones of RFCA.

##### **4.3.2. FY+1 Activities**

FY+1 activities are those that are being planned during the current FY and will be performed in the next FY. These activities include the following:

###### **January through May**

- DOE RFFO will submit to CDPHE, EPA, and the RFCAB a summary of the DOE budget request.

###### **July through October**

- DOE RFFO will provide EPA, CDPHE, and the RFCAB with copies of the Program Execution Guidance (PEG).

- DOE RFFO will consult with EPA and CDPHE in the development, verification, and review of draft Work Proposal Documents (WPDs) and CPB for FY+1
- DOE RFFO will review and revise CPB and regulatory milestones and target activities as necessary

#### **October through December**

- DOE RFFO and DOE HQ will brief EPA and CDPHE on the federal budget appropriation and tentative funding
- No more than 60 days after OMB apportionments DOE funds, DOE RFFO, EPA, and CDPHE will evaluate schedule, cost, and funding status of projects for the new FY to incorporate information into budget, milestone, and target DOE activities

If there is a delay in Congressional appropriations beyond the first day of the new fiscal year, DOE RFFO will inform EPA and CDPHE of any CRs, and of the impact of the delay on its ability to meet regulatory milestones and other requirements of the RFCA. EPA and CDPHE will review these actions and may recommend reallocation of available funds

#### **4.3.3. FY+2 Activities**

FY+2 activities are those which are being planned during the current year and will be performed two years from the current FY

#### **January through April**

- Within one week after DOE HQ issues planning/budget guidance, DOE RFFO will provide a copy of guidance to the EPA and CDPHE
- Within three weeks after DOE RFFO receives target level funding, DOE RFFO will provide its preliminary RFCA impact assessment
- Before submittal of the FY+2 budget request to DOE HQ, FY+2 baselines, regulatory milestones and target activities will be established or revised

#### **4.3.4. Roles and Responsibilities**

The budgetary roles and responsibilities for DOE RFFO include:

- Requesting necessary funds to meet RFCA regulatory milestones, target activities, and other commitments/requirements
- Interacting with DOE HQ regarding budget formulation document submittals, the presidential budget submittal, and problems with the RFETS cost baseline and budget
- Communicating RFETS objectives and priorities
- Conveying information and guidance to CDPHE, EPA, and the RFCAB

DOE RFFO's role focuses on maintaining the RFETS's CPB, preparing budget formulation documents, and ensuring that projects have the proper authorization basis for planning and execution. The role of CDPHE and EPA focuses on evaluating the CPB and funding status of projects to determine if the RFETS budget is adequate for meeting RFCA requirements and other environmental laws, and to establish milestones and target activities for the budget and planning years. EPA and CDPHE should be involved early in the budget process during the consultative process set forth in RFCA. All RFCA Parties have the responsibility to identify areas in the CPB where cost savings can be achieved to free funding for additional risk reduction activities.

#### **4.3 5. Cost Savings Initiatives and Productivity Improvements**

EPA and CDPHE shall consult with DOE RFFO during the RFETS budget planning and execution processes and other times deemed appropriate to identify and evaluate opportunities and incentives to improve productivity and reduce costs associated with activities at RFETS.

Standards, requirements, and practices shall be regularly reviewed to determine that activities at RFETS are conducted in a manner that is sufficient to achieve compliance with requirements and to protect workers, the public, and the environment, and necessary to accomplish the RFCA preamble objectives expeditiously and efficiently. Refer to RFCA ¶s 158-162 for additional guidance on cost savings and productivity improvements.

#### **4.4. ADMINISTRATIVE RECORD/RECORDS MANAGEMENT/DOCUMENT CONTROL**

##### **4.4.1. Administrative Record**

The AR is the compilation of documents relied on by DOE RFFO to select a response action for cleanup of a hazardous waste site. In accordance with Section 113(k) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986, AR files will be maintained for CERCLA response actions at or near RFETS, following EPA policies and guidelines. DOE RFFO is ultimately responsible for AR contents for RFETS.

The AR will be kept in accordance with CERCLA, NCP, and OSWER Directive 9833 3a-1 (EPA, 1994a) *Guidance on Administrative Record for Selecting of CERCLA Response Actions* and AR Implementation Procedure 2-S65-ER-ADM-17.02 *Administrative Record Document Identification and Transmittal* (RMRS, 1995a). An AR shall be established for each OU, for each ER action, and for each decommissioning action. Documents necessary to be included in each AR are delineated in OSWER Directive 9833 3a-1 (EPA, 1994a) (Appendix R).

RFETS procedure 1-F78-ER-ARP-001 *CERCLA Administrative Record Program* (RMRS, 1994b), establishes and defines the requirements and responsibilities for the compilation and maintenance of CERCLA AR files and completed ARs. Any future changes to AR policies and

guidelines affecting the AR files shall be discussed by DOE RFFO, EPA, and CDPHE and an agreement shall be reached on how best to accommodate those changes

EPA, after consultation with CDPHE when necessary, shall make the final determination of whether a document is appropriate for inclusion in an AR. EPA and CDPHE shall participate in compiling the AR by submitting documents to DOE RFFO as EPA and CDPHE deem appropriate. DOE RFFO will forward these documents to the RFETS AR files. Every AR file will be reviewed and approved by DOE RFFO, EPA, and CDPHE (i.e., Site Technical Administrative Record Review [STARR]) before the file is closed at the signing of the appropriate decision document.

Four information repositories have been established to provide the public with access to the AR. A copy of the AR is accessible to the public at times other than RFETS normal business hours through the Public Reading Room at Front Range Community College.

#### **Information Repositories**

**U.S. Environmental Protection Agency**  
Region VIII  
Superfund Records Center  
999 18th Street, Suite 500  
Denver, Colorado 80202-2466  
(303) 312-6473

**Rocky Flats Citizens Advisory Board**  
9035 Wadsworth Parkway  
Suite 2250  
Westminster, Colorado 80021  
(303) 420-7855

**Colorado Department of Public Health  
and Environment**  
Information Center, Bldg. A  
4300 Cherry Creek Drive South  
Denver, Colorado 80220-1530  
(303) 692-3312

**U.S. Department of Energy**  
Rocky Flats Public Reading Room  
Front Range Community College Library  
3645 West 112th Avenue  
Westminster, Colorado 80030  
(303) 469-4435

#### **4.4.2. Records Management**

The objectives of the RFETS records management program are to identify, capture, protect, and maintain active project records for both ER and decommissioning, index active records to ensure efficient and effective retrievability, safeguard records to prevent loss, damage, or unauthorized accesses, and turn over inactive records to the RFETS for disposition in accordance with approved record retention schedules. Final records disposition shall be approved by the DOE RFFO designee and be consistent with the CERCLA, RCRA, CHWA, and DOE RFFO records retention schedules, whichever is longer. DOE shall make all such records or documents available to CDPHE and EPA upon request.

RFETS procedure 1-V41-RM-001, *Records Management Guidance for Records Sources* (RMRS, 1996c), provides detailed guidance on the RFETS Records Management Program. Procedures for

implementation of the records management program elements identified in the above procedure are (1) RM-06 03 *Records Receipt, Processing, Retrieval, and Disposition* (RMRS, 1997a), and (2) RM-06 02 *Records Identification, Generation, and Transmittal* (RMRS, 1997b)

#### **4.4.3. Document Control**

Document control is the process of managing the authorized release of specific documents and changes to ensure that only the most current, approved-for-release copies of controlled documents are used to perform program activities, including those that prescribe activities affecting quality and safety. RFETS procedure 1-77000-DC-001, *Document Control Program* (RMRS, 1993), establishes requirements responsibilities, and instructions for the identification and control of controlled documents

#### **4.5. REPORTING**

All reporting shall be done in accordance with established DOE HQ and DOE Environmental Management policies and requirements DOE-stipulated elements focus on cost, schedule, and technical performance against approved baselines Additional reporting requirements established by DOE RFFO are provided in RFETS policy 1-R97-F&A-MCS-001, *Management Control Systems and ER Project Control Management Procedures and Requirements* (RMRS, 1996d)

RFCA Project Coordinators will meet at least monthly to discuss accomplishments, work in progress and anticipated work, potential changes to the baseline, implementation difficulties, compliance issues, opportunities for streamlining, and other matters of importance to implementation

Quarterly, DOE RFFO will provide EPA and CDPHE with a progress report that describes progress toward implementation of activities covered by RFCA Whenever possible, existing reports and databases will be used to fulfill this reporting requirement Upon request, DOE RFFO will provide EPA and/or CDPHE with copies of project status reports on a monthly basis

## **5. PUBLIC INVOLVEMENT AND STAKEHOLDER SUPPORT**

### **5.1. BACKGROUND**

Public involvement is an important part of the RFCA Vision. An effective public involvement strategy, as part of routine project planning, is required by both law and DOE policy for many project activities. In addition, it is the best management practice on any project potentially impacting public health. This section describes the RFETS approach to involving stakeholders in project decision making as RFETS progresses toward cleanup and closure.

All public involvement activities will be conducted in compliance with applicable requirements under NEPA, CERCLA, RCRA, and DOE Orders and guidelines. Those requirements and guidelines are identified in the RFSIPIP.

### **5.2. PUBLIC INVOLVEMENT OBJECTIVES**

The RFSIPIP is designed to increase stakeholders' understanding of the site's ER and waste management programs and to open avenues for stakeholders to participate in RFETS decision-making processes. This program has been developed to

- Provide accurate and timely information about environmental contamination and hazardous materials, cleanup plans, monitoring, and implementation progress
- Ensure stakeholders have the opportunity to provide input regarding planned actions and to have their opinions considered in decision-making
- Ensure DOE RFFO and its contractors understand and take into account stakeholder values and concerns
- Meet RCRA, CERCLA, NEPA, and RFCA public involvement requirements

Public involvement in the decision-making process will be conducted using the Rocky Flats Public Participation Guidance, which was created to ensure public involvement at RFETS meaningful (i.e., influential in the site decisions) and to optimize the effectiveness of public involvement efforts.

Additionally, public participation will adhere to the following guidelines and principles as outlined in RFCA:

- Ongoing consultation with the local elected officials
- Consistency with the RFETS long-term vision, mission, and budget
- Clear linkage to a decision-making process
- Adherence to state and federal requirements

- Stakeholder consultation on significant public policy issues, even if there is no legal requirement for involvement
- Inclusion of various and diverse community groups and people with varying levels of knowledge and understanding of RFETS issues

### **5.3. PUBLIC INVOLVEMENT PLANNING**

It is the responsibility of all managers at RFETS to plan for the appropriate level of stakeholder involvement as a primary element of site closure projects. Stakeholder involvement before selection of alternatives ensures decisions are made with full awareness of all relevant issues. Failure to involve stakeholders input at appropriate times can result in costly project delays and reformulation of plans. In developing a public involvement strategy, managers should base decisions about the level and timing of public involvement on the following:

- Probable impact on stakeholders
- Likelihood of value conflicts among stakeholders
- Level of perceived risk to stakeholders
- Uneven distribution of impacts of alternatives among stakeholder groups

Managers should consult with the DOE RFFO Office of Communication (OOC) during the project planning stages to develop a strategy for involving the public in project decisions, as well as to develop the tools necessary to implement that strategy. The OOC will prepare information for managers' use while engaging the public. The OOC coordinates outreach programs (e.g., Speakers Bureau and Tours and Visits) to promote additional face-to-face interaction.

Project-specific public involvement strategies, while not required for all projects, will provide the framework for soliciting stakeholder input. These strategies, or "mini" public involvement plans should identify the desired outcome of the strategy, the primary audience, the message, sensitive issues, and tools to be used.

Once the level of public involvement has been identified, it is important to communicate clearly what role the stakeholders have in the decision making process, to explain how the public fits into that process, and how public input will affect the decision. As a project progresses through planning into implementation, the extent to which public input can be effective will decrease. Accurately communicating the appropriate level of involvement can reduce misunderstanding.

#### **5.4. PUBLIC INVOLVEMENT TOOLS**

Using the tools below, the public involvement strategy will adhere to the objectives and meet requirements set forth in NEPA, RCRA, CERCLA, RFCA, and DOE Orders and guidelines. Other tools and resources can be developed and used as needed to promote effective public involvement. The OOC supports management in the proper use of these tools.

##### **Briefings, Presentations & Discussions**

Upon request, and to the extent possible, subject matter experts will meet with schools, groups, elected officials, regulators, individual stakeholders, and stakeholder organizations. The OOC prepared presentations on numerous topics are available for use.

##### **Public Hearings & Public Information Meetings**

The Site schedules public hearings and/or meetings as needed to disseminate information and accept feedback on key activities. Hearings usually are scheduled close to the midpoint of a public comment period. Public Information Meetings are not necessarily tied to specific public comment period and incorporate as many topics as appropriate to warrant the meeting. The OOC will plan, coordinate, and facilitate these public forums.

##### **Employee Meetings**

Employees are among the most important stakeholders at RFETS. It is important to keep employees informed and ensure they understand how their work contributes to the successful cleanup and closure of the site. Town hall meetings, cascading meetings, Manager's Information Meetings, staff meetings, and written and electronic newsletters provide to keep employees informed and solicit employee feedback about site activities.

##### **News Releases and Community Advisories**

The OOC disseminates information to news media outlets and key stakeholders and groups. In addition, the OOC serves as the point of contact for inquiries from news media and stakeholders.

##### **Fact Sheets**

The OOC creates brief informational materials (usually one or two pages in length) that identify key elements of specific projects and activities. Fact sheets describe processes and activities to assist stakeholders in understanding the projects.

### **Mailing List(s)**

RFETS maintains a facility mailing list of about 2,000 stakeholders interested in obtaining information about the Site. Separate mailing lists (e.g., RCRA mailing lists) are maintained that contain the names of smaller numbers of stakeholders interested in receiving information on specific topics.

### **Public Tours**

The OOC coordinates, plans, and conducts tours of the site to allow interested parties a first-hand look at work being accomplished at RFETS.

### **Speakers Bureau**

Knowledgeable site employees visit schools, civic groups, stakeholder organizations, and other groups to inform small audiences of site activities relevant to their interests.

### **Reading Rooms**

There are four locations throughout the Denver metropolitan area where interested parties can access information about RFETS. The Rocky Flats Public Reading Room contains thousands of documents relating to RFETS and other DOE weapons complex sites.

### **Electronic Access to Information**

Site information is available through Internet and Intranet access. Information for public dissemination will be made available on-line for stakeholders. An option of submitting comments on-line is in planning.

## **5.5. CONTACT NUMBERS**

Involving the public in RFETS decisions and clearly communicating stakeholders' roles in affecting decisions are paramount to successful Site closure. Regardless of legal requirements for public involvement, involving the stakeholders in decision-making building public trust and confidence that RFETS is being managed in the public interest. Teamwork between project managers, the OOC, and affected stakeholders will promote an effective strategy and use of communication tools to inform and involve stakeholders in the project activities.

#### **OOC Contact Telephone Numbers**

DOE Communication	(303) 966-5993
K-H Communication	(303) 966-7412

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**ENVIRONMENTAL CHECKLIST**  
**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE**

Form Revised 5/22/97

- 1 Project Name
- 2 Date Submitted
- 3 NEPA Tracking No
- 4 Charge Number.
- 5 WPD Number
- 6 Project Manager
- 7 Initiating Line Manager
- 8 Preparer (Bldg , Ext )
- 9 Project Description (be as detailed and specific as possible, use the checklist as a guide for issues to be addressed in the description of the project, submit to K-H NEPA for review)

Reviewed for Classification/UCNI

By \_\_\_\_\_

Date \_\_\_\_\_

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<u>NOTES</u>		<u>YES</u>	<u>NO</u>
10	Will the project require or potentially require permit application(s) or permit modification(s) under the		
A	Clean Air Act? (e g , APENs, Rad-NESHAP, and fugitive dust)	_____	_____
B	Clean Water Act? (e g , discharges, and chemicals)	_____	_____
11	Resource Conservation and Recovery Act (RCRA)		
A	Does the project generate, treat, store, or dispose of hazardous, radioactive, or mixed waste?	_____	_____
B	Does the project involve a removal?	_____	_____
C	Does the project include RCRA closure?	_____	_____
	-partial?	_____	_____
	-full?	_____	_____
D	Does the project include excavation or capping to meet RCRA requirements?	_____	_____
E	Will cost and duration stay within \$5 million and 60 months? (Explain in Section 9, Project Description)	_____	_____
F	Will a RCRA permit or permit modification be required?	_____	_____
12.	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)		
A	Is the project part of an activity required in the Rocky Flats Cleanup Agreement?	_____	_____
B.	If the answer to A. is YES, is the project described in a document that has been approved by EPA or CDPHE, or will be approved by at least one of those agencies before project work begins?	_____	_____
C	If the answers to both A and B are YES, has that document been reviewed by the National Environmental Policy Act (NEPA) Group for inclusion of NEPA values?	_____	_____
D	Has the project evaluated the potential for RFCA or IM/IRA performance monitoring obligations, and if appropriate, taken steps to implement those obligations through the IMP?	_____	_____

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- 13 A Will the project require performance monitoring per RFCA or IA IM/IRA requirements? \_\_\_\_\_
- B If the answer to A is YES, have appropriate steps been taken to implement those requirements through the Integrated Monitoring Plan? \_\_\_\_\_
- 14 Will the project create TSCA-regulated waste (asbestos & PCBs)? \_\_\_\_\_
- 15 Have all steps been taken to ensure compliance with procedures 1-G98-EPR-END 04, Migratory Bird Evaluation and Protection, and 1-D06-EPR-END 03, Identification and Protection of Threatened, Endangered, and Special-Concern Species? \_\_\_\_\_
- 16 Will the project be in or near an Individual Hazardous Substance Site (IHSS)? \_\_\_\_\_
- 17 Will this project construct or require a new or expanded waste disposal, recovery, storage, or treatment facility? \_\_\_\_\_
- 18 Is the project part of an agreement between DOE and another federal or state agency? (Specify and explain any schedule urgency and deadlines in Section 11, Project Description ) \_\_\_\_\_
- 19 Is the project
- A A new process, building, etc ? \_\_\_\_\_
- B A modification to an existing process, building, etc ? \_\_\_\_\_
- C An installation of capital equipment \_\_\_\_\_
- 20 Will the project be located in, or adversely affect designated
- A Wetlands? (i.e., dredge, fill operation) \_\_\_\_\_
- B Natural areas? \_\_\_\_\_
- C Prime agricultural land? \_\_\_\_\_
- D Special water sources? \_\_\_\_\_
- E Historical, archaeological, or architectural sites or buildings? (NHPA, HUD) \_\_\_\_\_
- F Impact surface water or groundwater \_\_\_\_\_

- |    |   |       |       |
|----|---|-------|-------|
| 21 | Will the project result in, or have the potential to result in, long term changes to the environment?   | _____ | _____ |
| 22 | Will the project result in changes or disturbances of the following existing conditions   |       |       |
|    | A Noise levels?   | _____ | _____ |
|    | B Solid wastes?   | _____ | _____ |
|    | C Radioactive wastes? (including disturbed or excavated contaminated soil)  | _____ | _____ |
|    | D Hazardous waste?  | _____ | _____ |
| 23 | Will the project have effects on the environment which are likely to be publicly controversial?   | _____ | _____ |
| 24 | Will the project establish a precedent for future projects that will have significant effects, or represent a "decision in principle" about a future consideration? | _____ | _____ |
| 25 | Is the project related to other projects or to a larger program?  | _____ | _____ |
| 25 | Have pollution prevention measures been considered? (Discuss in Section 11, Project Description )   | _____ | _____ |
| 26 | Does/Will the project present a radiation health and safety concern during construction or operation? (Price-Anderson Act)  | _____ | _____ |

NOTES:

**Appendix B**

**PREPARATION OF AN ER  
INTERIM MEASURE/INTERIM REMEDIAL ACTION  
DOCUMENT**

## **APPENDIX B**

### **1.0 PREPARATION OF AN ER INTERIM MEASURE/INTERIM REMEDIAL ACTION DOCUMENT**

RFCA §107 describes the IM/IRA process. That paragraph states

*The draft IM/IRA shall contain a brief summary of data for the site, a description of the proposed action, an explanation of how waste management considerations will be addressed, an explanation of how the proposed action relates to any long-term remedial action objectives, proposed performance standards, all ARARs and action levels related to the proposed action, and an implementation schedule and completion date for the proposed action.*

#### **1.1 IM/IRA Format and Content**

IM/IRAs are utilized for accelerated actions that will require more than six months for project execution and/or where the remedy is not straightforward and multiple alternatives have been evaluated. Alternative evaluation and selection are not necessary if a presumptive remedy has been selected. The suggested format for an IM/IRA is outlined below. In general, for actions where a formal alternatives analysis is performed, the IM/IRA will follow the format of EPA Guidance on *Conducting Non-time Critical Removal Actions Under CERCLA*, (August 1993). The EE/CA process is one method of performing a streamlined alternatives development and screening, and should be the upper bound of complexity for the IM/IRA Document. The intent of this guidance is to allow the complexity of the decision document to be based on the complexity of the project.

If an alternatives analysis is performed, the first part of the IM/IRA should describe the project to be performed using the selected remedy. The second part of the IM/IRA should describe the remedy selection process, and explain which remedy was selected and why.

The sections of an IM/IRA should include

- — Executive Summary (Optional)
- Purpose
- Project Description
- Project Approach
- Environmental Impacts
- Compliance with ARARs
- Implementation Schedule

The following sections are necessary if an alternatives analysis is performed

- Initial Selection and Screening of Alternatives
- Analysis of Alternatives

- Comparative Analysis of Alternatives and Remedy Selection
- Responsiveness Summary

The selected remedy will be described in the first part of the IM/IRA. The Responsiveness Summary will be included in either case.

## **1.2 EXECUTIVE SUMMARY**

The Executive Summary provides a general overview of the contents of the IM/IRA and is recommended only for complex problems where special issues are involved and/or where a formal alternative evaluation is performed. The summary should include a brief description of the IHSS or site, the nature of the contamination and related risks (or exceedence of action levels) and scope and objectives of the proposed removal action/interim measure. If a presumptive remedy has been selected, a short statement of why the presumptive remedy is appropriate should be included. If an alternatives analysis was performed, a brief discussion of the alternatives considered and basis for selection of the preferred alternative should be provided. Depending on the length and complexity of the IM/IRA, the Executive Summary is optional.

## **1.3 INTRODUCTION**

The introduction should briefly state:

- The nature of the contamination
- The proposed action
- The intent or goal of the proposed action

The introduction should state whether a presumptive remedy was selected, and why the remedy is appropriate (e.g., a similar remedy has been used in the past for similar contamination or type of problem). If an alternative analysis was performed, the introduction should state why a presumptive remedy was not selected (e.g., the setting or combination of contaminants, special hazards or other project-specific issues).

## **1.4 SITE DESCRIPTION**

The site description will provide IHSS/site information including the contamination history, geological and hydrogeological conditions, remedial investigation data, and a brief summary of risks posed by the contamination and how the action mitigates those risks. If the action is based on exceedence of the RFCA Action Levels, discuss how the action addresses these exceedences. This section will also include a brief description of how the proposed action is consistent with any long-term remedial objectives. If appropriate, the following Background, General Conditions, and Data Summary subsections can be combined into one section: Existing Conditions and Conceptual Model.

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#### **1.4.1 Background**

The background section will describe the nature and history of the contamination source. This may include historical information on spills or other releases, any waste operations associated with the contamination, and the relationship between the contamination and other IHSSs.

#### **1.4.2 General Conditions**

This summary describes the site-specific conditions or pertinent data to support the rationale for undertaking the action, such as the geological and hydrogeological conditions of the area to be remediated.

Only information relevant to the proposed action should be discussed. General discussions of the site geology, geographic setting, and other general physical characteristics should be referenced to existing documents, such as the site-wide geochemistry and hydrogeology reports.

#### **1.4.3 Data Summary**

This section summarizes past remedial investigations or any other available relevant data.

This would include, if relevant:

- Appropriate field investigations such as HPGe surveys, soil gas surveys, etc.
- Groundwater, surface water, soil and/or other relevant analytical results
- Field observations
- Waste disposal data and history
- Any other appropriate, available historical data

The information from the above sections may be presented in a plan view (map), a cross-section (if appropriate), tabular form, or narrative. Locations of relevant sampling points should be shown in relation to the site or area to be remediated. It is helpful to integrate the available data into a conceptual model showing the relationship of the contamination to groundwater, buildings and other structures, surface water, slopes, underground utilities, and other physical items that may impact the project execution.

### **1.5 PROJECT APPROACH**

Proposed action objectives narrative and numerical remedial goals are described here. This should be a brief and concise statement of the intended objectives of the action. Remedial action objectives will include meeting specified cleanup targets for the media being remediated.

If an alternatives analysis was performed, briefly state here specifically what the selected remedy is, and the basis for selection. Refer to the following sections for details on how this remedy will be implemented. If no alternatives analysis was performed, address the reason that the No

Action Alternative was not selected (i.e., the site poses a risk, contaminants are above specified action levels, etc.)

### 1.5.1 Proposed Action

This section details the proposed action including the scope of the action, the proposed remediation methodology, cleanup levels, and site restoration. Where applicable, these details would include information on

- The scope or extent of the action, including projected volumes of any environmental media to be removed and/or treated
- Excavation methods
- Material handling
- Groundwater or surface water containment and/or recovery methods
- Treatment methods for water, soils, sediments, debris, or other materials generated, including tabulated performance standards for treatment
- Transportation or staging requirements
- Any control measures to minimize the environmental impact of the proposed action (i.e., dust suppression, containment measures, surface water protection)
- Performance monitoring in accordance with the IMP
- Site restoration including any revegetation, backfilling, or regrading

Sampling and analysis requirements will be deferred to the project-specific SAP developed in accordance with the guidelines in Section 3.2 of the IGD

### 1.5.2 Worker Health and Safety

This section will include a brief description of the basis for the health and safety requirements, the hazards, monitoring requirements, personal protective equipment (PPE), and actions to protect human health. Action-specific HASP and Hazards Analysis (HA) will be prepared separately.

### 1.5.3 Waste Management

This section will describe the storage requirements and final disposition of all waste streams that will be generated. Remediation wastes are defined in RFCA §25bf as

*Remediation waste means all*

- (1) Solid hazardous, and mixed wastes,
- (2) All media and debris that contain hazardous substances, listed hazardous or mixed wastes that exhibit a hazardous characteristic, and

- (3) *All hazardous substances generated from activities regulated under this Agreement as RCRA corrective actions or CERCLA response actions, including decommissioning*

*Remediation waste does not include wastes generated from other activities. Nothing in this definition confers RCRA or CHWA authority over source, special nuclear, or byproduct material as those terms are defined in the Atomic Energy Act*

## 1.6 NEPA

This section is included to identify how NEPA values are incorporated into the decision document. Ideally the NEPA values will be woven throughout the decision document so that they are considered at all phases of the decision making. This section provides an opportunity to reiterate how NEPA values may have been considered in other parts of the decision document, and to touch upon other NEPA values that may not have been directly addressed. The NEPA values to be considered include

- Air quality during construction and operation of the project
- Water quality (including both surface water, wetlands, and groundwater and the flow characteristics of each)
- Flora and fauna (including threatened and endangered species)
- Historic and cultural resources
- Human health
- Consideration of alternatives including no action
- Irreversible and irretrievable commitment of resources
- Short-term versus long-term use of the proposed site
- Indirect effects
- Cumulative effects (effects from the current project added to the effects from other known projects affecting the same site)

## 1.7 COMPLIANCE WITH ARARS

This section consists of an analysis of Federal and State ARARs. Chemical-specific, location specific, and action-specific ARARs are identified and tabulated. Section 3.5 of the IGD discusses development and selection of ARARs.

## 1.8 IMPLEMENTATION SCHEDULE

This section will include a general schedule of when the project is to be implemented, including commencement of field activities and report generation. The format of the schedule will be

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project-specific Milestones will be presented at a summary level with nonspecific dates, e g ,  
"field activities will commence in the second quarter of 1999 "

## **2.0 INITIAL SELECTION AND SCREENING OF ALTERNATIVES**

Only a limited number of alternatives (two to four) need to be considered for the IM/IRA Only the most qualified technologies and/or alternatives that apply to the chemicals of concern (COCs) and affected media need be considered To the extent possible, presumptive remedies or previous actions for similar situations should be used as a basis for decisions In these cases, the decision document should reference previous decision documents whenever possible, with the intent of minimizing decision processes

Each of the alternatives should be discussed in sufficient detail so that the entire process can be understood For example, treatment and/or disposal of residuals resulting from the remedy should be addressed

The selected alternatives are evaluated for effectiveness, implementability, and cost This evaluation is based on the scope of the IM/IRA and each of its specific objectives The evaluation encompasses the criteria addressed in a full scale CMS/FS, but is done in a much more streamlined manner The following discussion provides more detailed descriptions of each criterion The EPA *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA* (EPA, 1993) should be consulted for a description of the alternative screening and evaluation process

### **2.1 EFFECTIVENESS**

This criteria considers whether or not the alternative provides protection of public health and the environment Long-term effectiveness, short-term effectiveness, and compliance with ARARs are evaluated for overall protection of public health and the environment

Short-term effectiveness relates to the protection provided during implementation and before the IM/IRA objectives have been met It addresses such items as impacts due to fugitive dusts, transportation of hazardous materials, and toxic fumes produced during implementation Impacts on the local community, the workers implementing the action, and the environment are included

Long-term effectiveness addresses the level of risk remaining after the action has been completed and the need for addition of controls The degree to which the alternative reduces toxicity, mobility or volume of contamination and how this in turn reduces risk or potential threats is also discussed

This section must summarize ARARs for the proposed IM/IRA action The requirements should be presented as a summary table in the IM/IRA Decision Document, with a brief discussion in the text of this section. The alternatives evaluation will include a discussion, in general terms, of whether or not they can be complied with and what cost and schedule impacts pertain to each alternative A detailed ARARs evaluation will be included elsewhere in the IM/IRA

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## **2.2 IMPLEMENTABILITY**

*This criteria addresses the technical and administrative feasibility of implementing an alternative and the availability of the services and materials required. Technical feasibility relates to the maturity and complexity of the technology being evaluated. Construction feasibility, and operations and maintenance requirements are also considered.*

*Administrative feasibility relates to the need for coordination with other offices and agencies, such as requirements for building permits, easements, or zoning variances. Availability of services and materials relates to the need for skilled labor/technicians to operate the technology/process, offsite treatment/storage/disposal, utilities, and laboratory services.*

*Finally, the implementability criteria includes a consideration of the acceptability of the alternatives to the State and local community.*

## **2.3 COST**

*Evaluation of costs should consider the capital costs to engineer, procure, and construct the required equipment and facilities, and the operating and maintenance costs associated with the alternative. The cost estimates can be "order-of-magnitude" with sufficient accuracy to allow comparison and ranking of the alternatives on a present worth basis for alternatives that involve more than one year of operation and maintenance. For the alternative evaluation section of the IM/IRA, the alternatives will be compared on a qualitative basis using descriptors such as high, medium, or low.*

*The results of the analysis will be presented in the IM/IRA Decision Document for each alternative evaluated. This analysis will be summarized in a table similar to Table 2-1.*

*Based on the analysis, a decision will be made as to whether or not each alternative considered should be retained for the comparative analysis, which is discussed in the next section. The reason for eliminating an alternative should also be discussed.*

**Table 2-1 Initial Screening of Alternatives**

<b>EFFECTIVENESS</b>
Protectiveness
Public Health
Workers
Environment
Attains ARARs
Achieve Remedial Objectives
Level of treatment/containment
No residual effect concerns
Maintains control until long-term solution implemented
<b>IMPLEMENTABILITY</b>
Technical Feasibility
Construction and operation
Demonstrated performance
Adaptable to environmental conditions
Need for permits
Availability
Equipment
Personnel and services
Outside laboratory testing
Offsite treatment and disposal
Post-removal site control
Administrative Feasibility
Permits required
Easements of right-of-ways required
Impact on adjoining property
Ability to impose institutional controls
<b>COST</b>
Capital Cost
Operation and Maintenance
Present worth cost

## **2.4 COMPARATIVE ANALYSIS OF ALTERNATIVES**

Alternatives that pass the initial screening based on effectiveness, implementability, and cost are now compared against each other. At this point a remedy may be selected if there is an obvious benefit to a single remedy during the initial screening. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another so that one of them can be identified as the recommended action.

The actual comparison may be made on a semi-quantitative ranking system based on effectiveness, implementability and cost. After each category has been scored, a total score (low, medium, high) is obtained. The alternative with the highest score would probably be the recommended alternative, assuming that it is cost effective. Generally, a matrix indicating the relative scores of the alternatives and the justifications for the scores is the best method for presentation.

If there is no best alternative by this method, it may be necessary to add additional criteria and/or weighing factors to the criteria to differentiate between the alternatives.

## **2.5 RESPONSIVENESS SUMMARY**

The approved responsiveness summary from the public comment period will be attached to the final approved IM/IRA.

## **3.0 GENERIC IM/IRA SCHEDULE**

The attached generic schedule is for the development of an IM/IRA. Variations for each IHSS may influence the duration of specific activities. This schedule may be used as a planning basis.

## **4.0 COMMENT RESPONSIVENESS SUMMARY**

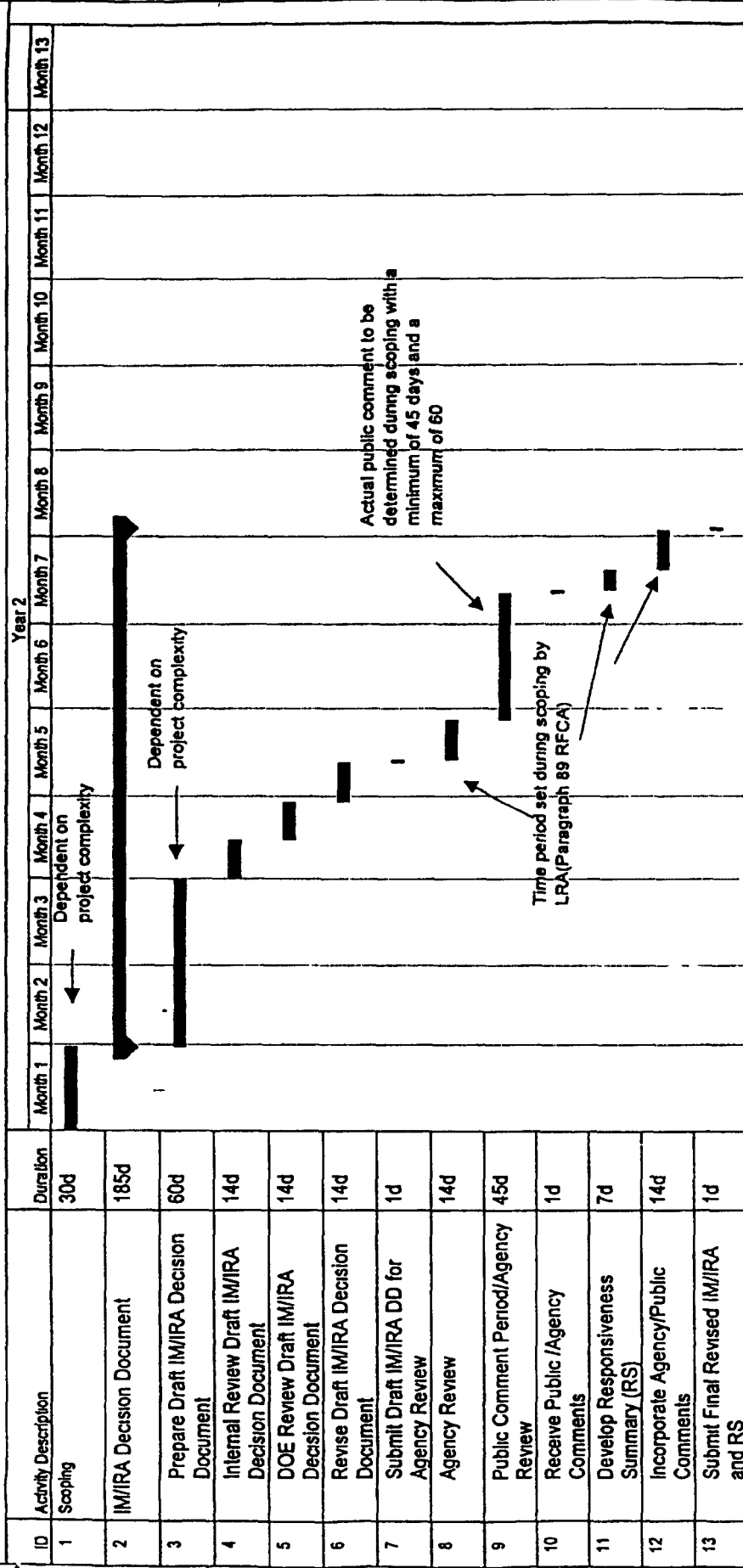
This section will be included to document responses to public and agency comments if a separate responsiveness summary is not created.

## **5.0 DECISION MODIFICATION PROCESS**

The decision modification process for IM/IRAs is discussed in Section 3.10 of the IGD, and in Part 10 of the RFCA.

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# Generic IM/IRA Schedule



Task

IM/IRA  
GENERIC SCHEDULE

Summary

Progress

## APPENDIX C

### 1.0 PREPARATION OF AN ER PROPOSED ACTION MEMORANDUM

#### 1.1 PAM FORMAT

RFCA §106 describes the PAM process

*The Draft PAM shall contain a brief summary of data for the site, a description of the proposed action, an explanation of how waste management considerations will be addressed, an explanation of how the proposed action relates to any long-term remedial action objectives, proposed performance standards, all ARARs and action levels related to the proposed action, and an implementation schedule and completion date for the proposed action*

The PAM is the decision document for accelerated response action requiring less than six months for project execution. The length and complexity of the PAM will depend on the complexity of the project. The development of the sections included in a PAM is discussed in the following sections.

The sections of a PAM include

- Purpose
- Project Description
- Background
- Project Approach
- Environmental Impacts
- Compliance with ARARs
- Implementation Schedule
- Comment Responsiveness Summary

#### 1.2 PURPOSE

This introduction briefly states

- The nature of the contamination

- The proposed action
- The intent or goal of the proposed action

### **1.3 SITE DESCRIPTION**

The project description provides site information including history, geological and hydrogeological conditions, remedial investigation data, a brief summary of risks posed by the site and how the action will mitigate the risks. This section will also include a brief description of how the proposed action is consistent with any long-term remedial objectives. If appropriate, the Background, General Conditions, and Data Summary subsections can be combined into one section entitled Existing Conditions and Conceptual Model. The section would contain the same information and integrate it into a conceptual model of the site, including known and expected contaminant distribution and factors expected to impact the project (e.g., shallow groundwater).

#### **1.3.1 Background**

The background section describes the nature and history of the contamination source. This potentially includes historical information on spills or other types of releases, any waste operations associated with the contamination, and the relationship between the contamination and other IHSSs.

#### **1.3.2 General Conditions**

This summary describes site-specific conditions or pertinent data to support the rationale for undertaking the action such as the geological and hydrogeological conditions of the area to be mitigated. Information relevant to the action may include

- Underlying stratigraphy
- Depth to groundwater
- Saturated thickness
- Mean hydraulic conductivity and gradient
- Seasonal effects
- Any relevant information on seeps or surface water locations

Only information relevant to the proposed action should be discussed. General discussions of the site geology, geographic setting, and other physical characteristics should be referenced to existing documents.

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### **1.3.3 Data Summary**

This section summarizes past remedial investigations This would include, if relevant

- Geophysical survey information
- Borehole sampling results
- Groundwater sample results
- Surface water sample results
- Surface soil, sludge, or sediment sample results
- Field screening results
- Free product samples and thickness measurements
- Samples and smears from tanks and pipelines
- Field observations
- Any other appropriate, available historical data

## **1.4 PROJECT APPROACH**

This section provides a brief and concise statement of the intended objective of the accelerated action

### **1.4.1 Proposed Action Objectives**

This section details the proposed action including the scope of the action, the proposed remediation methodology, cleanup levels, and site restoration Where applicable, these details would include information on

- The scope or extent of the action including projected volumes of any environmental media removed and/or treated
  - Excavation methods
  - Material handling
  - Groundwater or surface water recovery methods
  - Treatment methods for water, soils, sediments, debris, or excess equipment, including tabulated performance standards for treatment
  - Transportation or staging requirements
  - Any control measures to minimize the environmental impact of the proposed action, (e g , dust suppression, and containment measures)
  - Performance monitoring in accordance with the IMP
-

- Site restoration including any revegetation, backfilling, or regrading

Discussion of sampling and analysis will be deferred to the project-specific sampling and analysis plan developed as per the guidelines in Section 3.2 of the IGD

#### **1.4.2 Worker Health and Safety**

This section will include a brief description of the basis for health and safety requirements, the hazards, monitoring requirements, PPE, and actions to protect human health. An action-specific HASP will be prepared separately.

#### **1.4.3 Waste Management**

This section will describe the storage and management requirements and final disposition of all waste streams that will be generated. Remediation wastes are defined in RFCA ¶25bf as

*Remediation waste means all*

- 1) Solid hazardous, and mixed wastes,*
- 2) All media and debris that contain hazardous substances, listed hazardous or mixed wastes that exhibit a hazardous characteristic, and*
- 3) All hazardous substances generated from activities regulated under this Agreement as RCRA corrective Actions or CERCLA response actions, including decommissioning*

*Remediation waste does not include wastes generated from other activities. Nothing in this definition confers RCRA or CHWA authority over source, special nuclear, or byproduct material as those terms are defined in the Atomic Energy Act*

#### **1.5 NEPA**

This section is included to identify how NEPA values are incorporated into the decision document. Ideally the NEPA values will be woven throughout the decision document so that they are considered at all phases of the decision making. This section provides an opportunity to reiterate how NEPA values may have been considered in other parts of the decision document, and to touch upon other NEPA values that may not have been directly addressed. The NEPA values to be considered include

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- Air quality during construction and operation of the project
- Water quality (including both surface water, wetlands, and groundwater and the flow characteristics of each)
- Flora and fauna (including threatened and endangered species)
- Historic and cultural resources
- Human health
- Limited consideration of alternatives including no action, as appropriate
- Irreversible and irretrievable commitment of resources
- Short-term versus long-term use of the proposed site
- Indirect effects
- Cumulative effects (effects from the current project added to the effects from other known projects affecting the same site)

#### **1.6 COMPLIANCE WITH ARARS**

This section consists of an analysis of federal and state ARARs. Chemical-specific, location-specific, and action-specific ARARs are identified and summarized in a table. Section 3.5 of the IGD discusses identification and evaluation of ARARs.

#### **1.7 IMPLEMENTATION SCHEDULE**

This is a general project schedule including commencement of field activities and report generation. The format of the schedule will be project-specific. Milestones will only be presented at a summary level with nonspecific dates (e.g., "field activities will commence in the second quarter of 1999"). The attached generic schedule for PAMs may be used as a starting point for project planning.

#### **1.8 COMMENT RESPONSIVENESS SUMMARY**

This section will be included if a separate responsiveness summary is not created. Written comments from the public comment process will be documented followed by responses to individual or group comments that have similar focus.

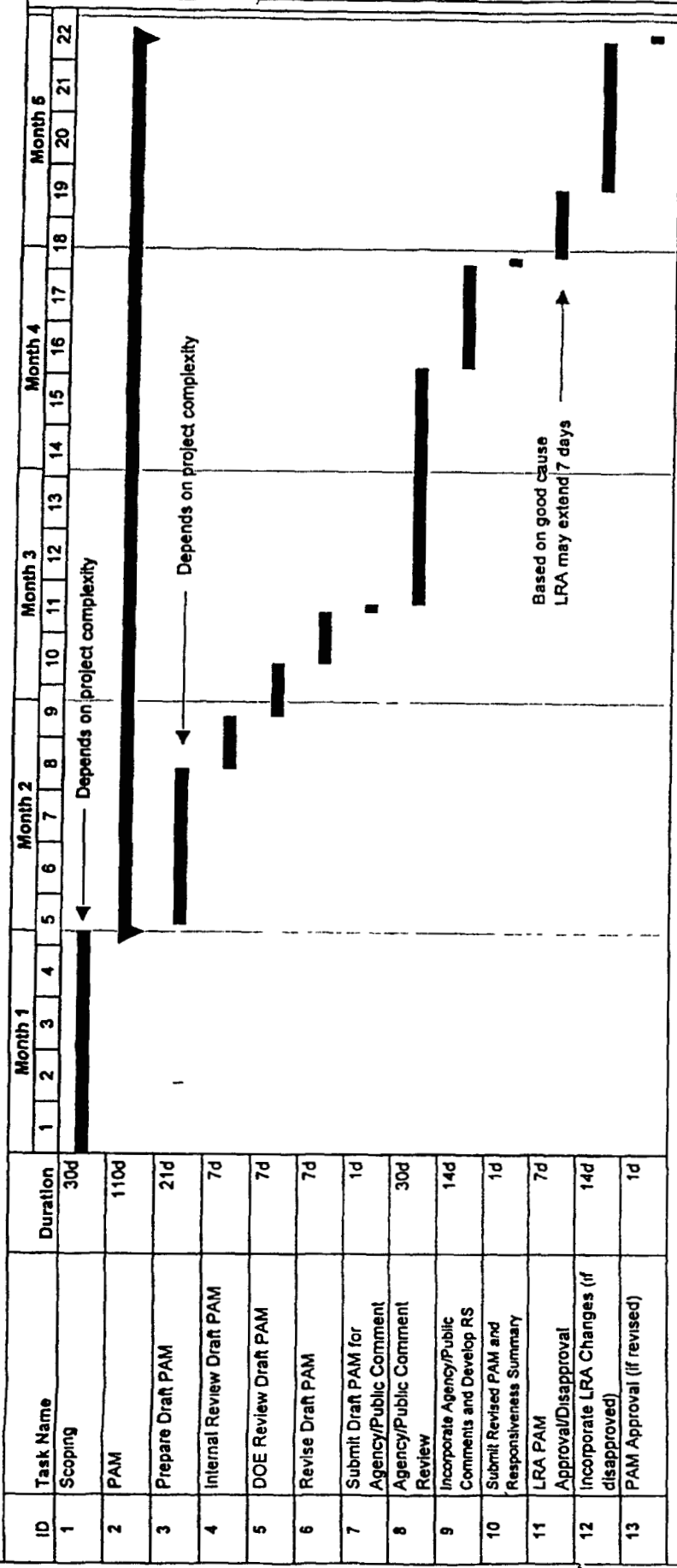
#### **1.9 DECISION MODIFICATION PROCESS**

The decision modification process for PAMs is described in Section 3.10 of the IGD.

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GENERIC PAM SCHEDULE



## **APPENDIX D**

### **1.0 PREPARATION OF AN RFCA STANDARD OPERATING PROTOCOL DOCUMENT**

RFCA ¶25(b) defines a Rocky Flats Cleanup Agreement Standard Operating Protocol (RSOP). That paragraph states

*RSOP means approved protocols applicable to a set of routine environmental remediation and/or decommissioning activities regulated under this Agreement that DOE may repeat without re-obtaining approval after initial approval because of the substantially similar nature of the work to be done. Initial approval of an RSOP will be accomplished through an IM/IRA process.*

#### **1.1 EXECUTIVE SUMMARY**

The Executive Summary provides a general overview of the contents of the RSOP. Depending on the length and complexity of the RSOP, the Executive Summary is optional.

#### **1.2 INTRODUCTION**

The introduction should briefly state

- The purpose of the RSOP (define why the RSOP is needed and intent or goal of action)
- The proposed action (i.e., the scope of this RSOP)

#### **1.3 PROJECT APPROACH**

##### **1.3.1 Proposed Action**

This section provides a description of the proposed action including the scope of the RSOP, the proposed remediation methodology, cleanup levels, and site restoration. Where applicable, these details would include information on

- Monitoring requirements during implementation of the RSOP
- The scope or extent of the action, including projected volumes of any process or remediation waste to be removed and/or treated
- How the proposed action relates to any long-term remedial action objectives

### **1.3.2 Worker Health and Safety**

This section will include a brief description of the basis for the health and safety program or plan requirements, the hazards, monitoring requirements, PPE, and actions to protect human health. Action-specific HASP and HA will be prepared separately.

### **1.3.3 Waste Management**

This section will describe the management requirements and final disposition of all waste streams generated other than the waste specifically addressed in this RSOP. (For example, secondary waste generated as a result of this activity.)

## **1.4 ENVIRONMENTAL CONSEQUENCES**

This section is included to identify how NEPA values and potential environmental consequences are incorporated into the decision document. Ideally the NEPA values will be woven throughout the decision document so that they are considered at all phases of the decision making. This section will reiterate how NEPA values and potential environmental consequences of the activities may have been considered in other parts of the decision document, and to touch upon other NEPA values and potential environmental consequences that may not have been directly addressed. The NEPA values and potential environmental consequences to consider include:

- Soils and geology
- Air quality
- Water quality
- Human health and safety
- Ecological resources
- Historic resources
- Visual Resources
- Noise
- Transportation
- Unavoidable adverse effects
- Short-term uses versus long-term effects
- Irreversible and irretrievable commitments

## **1.5 COMPLIANCE WITH ARARS**

This section consists of an analysis of Federal and State ARARs. Chemical-specific, location-specific, and action-specific ARARs are identified and tabulated. Section 3.5 of the IGD discusses development and selection of ARARs.

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## **1.6 IMPLEMENTATION SCHEDULE**

Once the regulatory agencies initially approve the RSOP, DOE RFFO may implement the RSOP throughout the duration of the Rocky Flats Closure Project. DOE RFFO will notify the regulatory agencies prior to implementing the RSOP for a specific-project. Project-specific approval by the regulatory agencies to use the RSOP is not required.

## **1.7 RESPONSIVENESS SUMMARY**

The approved responsiveness summary from the public comment period will be attached to the final approved RSOP. (Alternatively, may include a section within the final RSOP to document responses to public and agency comments if a separate responsiveness summary is not included.)

## **1.8 ADMINISTRATIVE RECORD**

This section will contain the Administrative Record file and proposed Administrative Record for this decision. After completion of the public comment period, all comments received from the public, the responsiveness summary and the approval letter will be added to the Administrative Record file. Approval of this decision document is approval by the regulators of the Administrative Record for the actions covered by the RSOP.

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## APPENDIX F

### 1.0 CLOSURE DATA MANAGEMENT

A variety of data will be generated during Closure. These data include, but are not limited to

- Air monitoring data
- Meteorological data
- Ecological data
- Surface water monitoring data (including physical and chemical information)
- Groundwater monitoring data (including analytical and field parameters)
- Well construction data
- Geological information
- Spatial data
- Waste characterization data
- Field instrument data
- Soils data (analytical and physical data)
- Other characterization data (including HPGe field data)

The main types of environmental data collected during the Closure process are graphically shown in Figure F-1. These data are vital to successful 2006 Closure and must be collected, stored, managed, and used appropriately to support Closure decision-making and regulatory Closure via the CAD/ROD. The data must be of sufficient quality to support decisions, managed in a manner that allows repeat use, and secured for both required recordkeeping and provision of data to final Site stewards. The requirement of future availability and repeat use dictates that data are stored centrally using consistent and easily identifiable titles and labels. **This management is the responsibility of the Closure Operations group with support and infrastructure provided by the Closure Support Group.**

The following sections outline specific Closure data management and quality requirements for all projects conducted under RFCA.

F-2

## 1.1 ENVIRONMENTAL DATA QUALITY AND USABILITY

Environmental data quality is a multi-step process that ensures the data collected at part of RFCA projects are sufficient for their intended use. In most instances, analytical data collected in support of a SAP should be evaluated using the guidance described in the Rocky Flats Administrative Procedure 2-G32-ER-ADM-8 02, *Evaluation of ERM Data for Usability in Final Reports*. This procedure establishes the guidelines for evaluating analytical data with respect to the PARCC parameters, which address the overall quality of the data collected and their usability by the project for decision making. The PARCC process and analytical data quality assessment process are discussed in the following sections.

### 1.1.1 PARCC Process

The definition of PARCC parameters and the specific applications to the investigation are as follows:

**Precision** A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference and the greater the precision. The relative percent differences (RPD) for results of duplicate and replicate samples will be tabulated according to matrix and analytical suites to compare for compliance with established precision DQOs. Deficiencies will be noted and qualified, if required. Evaluation of precision encompasses an evaluation of the sample collection process as well.

**Accuracy** A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement. The actual analytical method and detection limits will be compared with the required analytical method and detection limits for VOCs and radionuclides to assess the DQO compliance for accuracy.

**Representativeness** A quantitative characteristic of data quality defined by the degree to which the data absolutely and exactly represented the characteristics of a population. Representativeness is accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest. The actual sample types and quantities will be compared with those stated in the SAP or other related documents and organized by media type and analytical suite. Deviation from the required and actual parameters will be justified, as required.

**Completeness** A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. A completeness goal of 90% has been set for SAPs. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO usability goals. If sample data cannot be used, the non-compliance will be justified, as required.

**TABLE F-1 PARCC PARAMETER SUMMARY**

PARCC	Radionuclides	Non-Radionuclides
Precision	Duplicate Error Ratio $\leq 1.42$	
Accuracy	Detection Limits per method and ASD Laboratory SOW	Comparison of Laboratory Control Sample Results with Real Sample Results
Representativeness	Based on SOPs and SAP	Based on SOPs and SAP
Comparability	Based on SOPs and SAP	Based on SOPs and SAP
Completeness	90% Useable	90% Useable

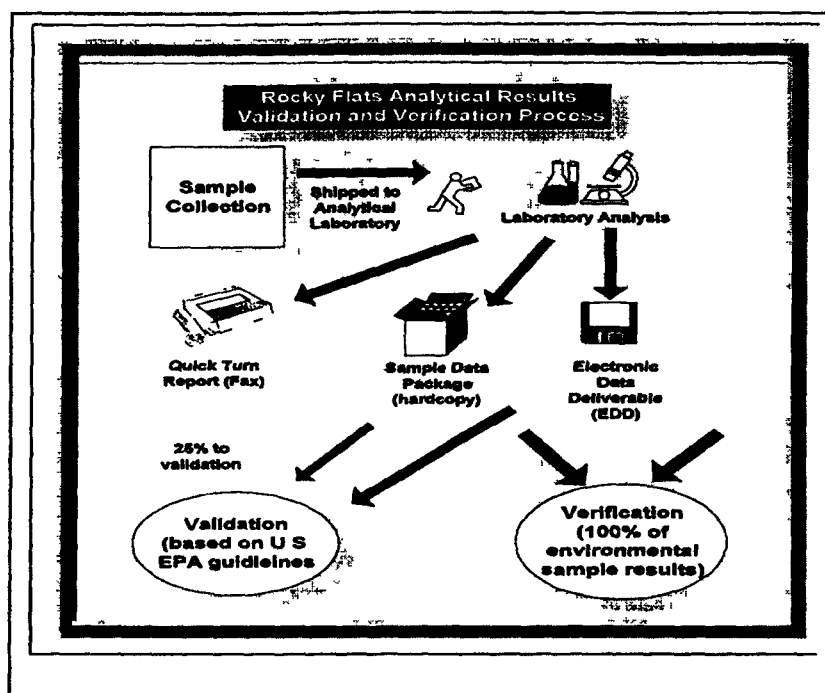
**Comparability** A qualitative measure defined by the confidence with which one data set can be compared to another. Comparability will be attained through consistent use of industry standards (e.g., SW-846) and standard operating procedures, both in the field and in laboratories. Statistical tests may be used for quantitative comparison between sample sets (populations). Deficiencies will be qualified, as required. Quantitative values for PARCC parameters for the project are provided in Table F-1.

#### **1.1.2 Analytical Data Assessment Process**

RFETS Analytical Services group provides analytical data assessment on all environmental data collected to support the Closure Mission. Data usability shall be performed on laboratory validated data according to procedure 2-G32-ER-ADM-08 02, *Evaluation of ERM Data for Usability in Final Reports*. The RFETS environmental data assessment process is outlined below.

#### **Data Assessment**

As shown in Figure F-2, all analytical data generated in conjunction with environmental activities at Rocky Flats are assessed to evaluate the performance of analytical laboratories with respect to contract requirements for quality. Data Assessment is a generic term for a quality assurance evaluation of analytical chemistry data. This assessment involves



**Figure F-2 Rocky Flats validation and Verification Process**

- **Initial review** of the data package by the laboratory performing the analysis
- **Cursory examination** of the data by Rocky Flats Analytical Services Division (ASD) Personnel prior to customer release of preliminary data .
- **Verification** of data packages in accordance with Rocky Flats Verification and Validation Guidelines Verification is an assessment process to ensure data meets specified contractual data quality requirements The verification process employed on environmental data serves as a comprehensive quality control assessment with the exception of raw data review and calculation checks This level of assessment includes a random comparison of hard copy results against the electronic data deliverable (EDD) Validation of a selected percentage of the data packages from all laboratories serves as a check to determine if any systematic reporting or calculation problems exist, and may be applicable to those data packages that receive data assessment at the verification level Current guidelines require 75 percent of the environmental data are verified
- **Validation** of data packages in accordance with Rocky Flats Verification and Validation Guidelines Validation is a comprehensive examination of a data package to determine compliance to data quality requirements, to ensure raw data supports reported values, and to evaluate the laboratory's compliance to subcontract reporting and deliverable requirements This level of assessment includes a complete comparison of EDD data with data reported on the

hardcopy sample data package. Current guidelines require 25 percent of the environmental data are validated in accordance with *General Guidelines for Data Verification and Validation - DA-GR01-V1* (December 3, 1997). Additional details on the RFETS analytical data assessment process are found on the RFETS Intranet at [http://rfetshp/Analytic\\_Services/dataq.htm](http://rfetshp/Analytic_Services/dataq.htm)

All analytical laboratories supporting the RFETS Closure Mission are routinely audited to ensure performance in accordance with contract specifications.

ASD also provides results for a majority of environmental analysis via an EDD, which includes information on the results of the data validation/verification process. The EDDs are designed for import into site environmental data systems to support further analysis and interpretation of the data.

Projects collecting and reporting non-laboratory data, such as field parameters, geologic logging, ecological sampling, etc., are required to follow and document adherence to Site and program specific QA/QC procedures.

## 1.2 ENVIRONMENTAL DATA MANAGEMENT

Appropriate management of RFETS environmental data is essential to Closure and a key responsibility of project managers conducting RFCA Closure projects. The majority of environmental data are available electronically and are stored in shared data systems. Each of these systems has been reviewed and tested for Y2K compliance and have been approved for operation for the remainder of the Closure Mission. Current environmental data systems are shown in Table F-2.

Most environmental data systems have been upgraded in the last year and several are scheduled for upgrade during FY00. Once upgrades are complete, all environmental data systems will be in a common site standard platform to facilitate integration of data and information among media.

Projects that collect Closure environmental data are required to store their data in the applicable database. In this way, such data will be easily available for secondary uses, as well as available in the future, long after the original project is completed and closed out. This relieves the RFCA project manager from long-term data management requirements beyond Site-required record keeping requirements. All data entered into environmental data systems must have a location and sampling event identified in accordance with Closure Project protocols.

**TABLE F-2 CURRENT DATA SYSTEMS AT RFETS**

Environmental Data System	Platform in FY00	Typical Data
Air Monitoring System Database (AMSD)	Oracle	Effluent air, ambient air, meteorology
Soil Water Database (SWD)	Oracle	Soil, groundwater, surface water, HPGe, water levels, field parameters, flow
Flow	Oracle	Surface water flow
Ecology Database (SED)	Access (later migration to Oracle)	Ecological species, soil types, sampling locations
Administrative Record (AR)	FileMaker (migration to Oracle and web enabled)	Index of administrative record documents
Integrated Sitewide Environmental Data System (ISEDS)	Oracle/access - web enabled	"raw" analytical data, electronic field measurements, interpreted data sets "residual" data sets
Geographic Information System (GIS)	ArcInfo	Spatial data
Analytical Services Toolkit (AST)/EDDProPlus (BIG EDD)	Access/Oracle	Laboratory analyses tracking, electronic laboratory analyses (EDD)
Waste Stream and Residue Identification and Characterization (WSRIC)	Oracle	Waste characterization
Waste Environmental Management System (WEMS)	Oracle	Waste container tracking

Figure F-3 shows a roadmap of requirements on where to direct environmental data collected during closure activities. Additional details on requirements are presented in the following paragraphs.

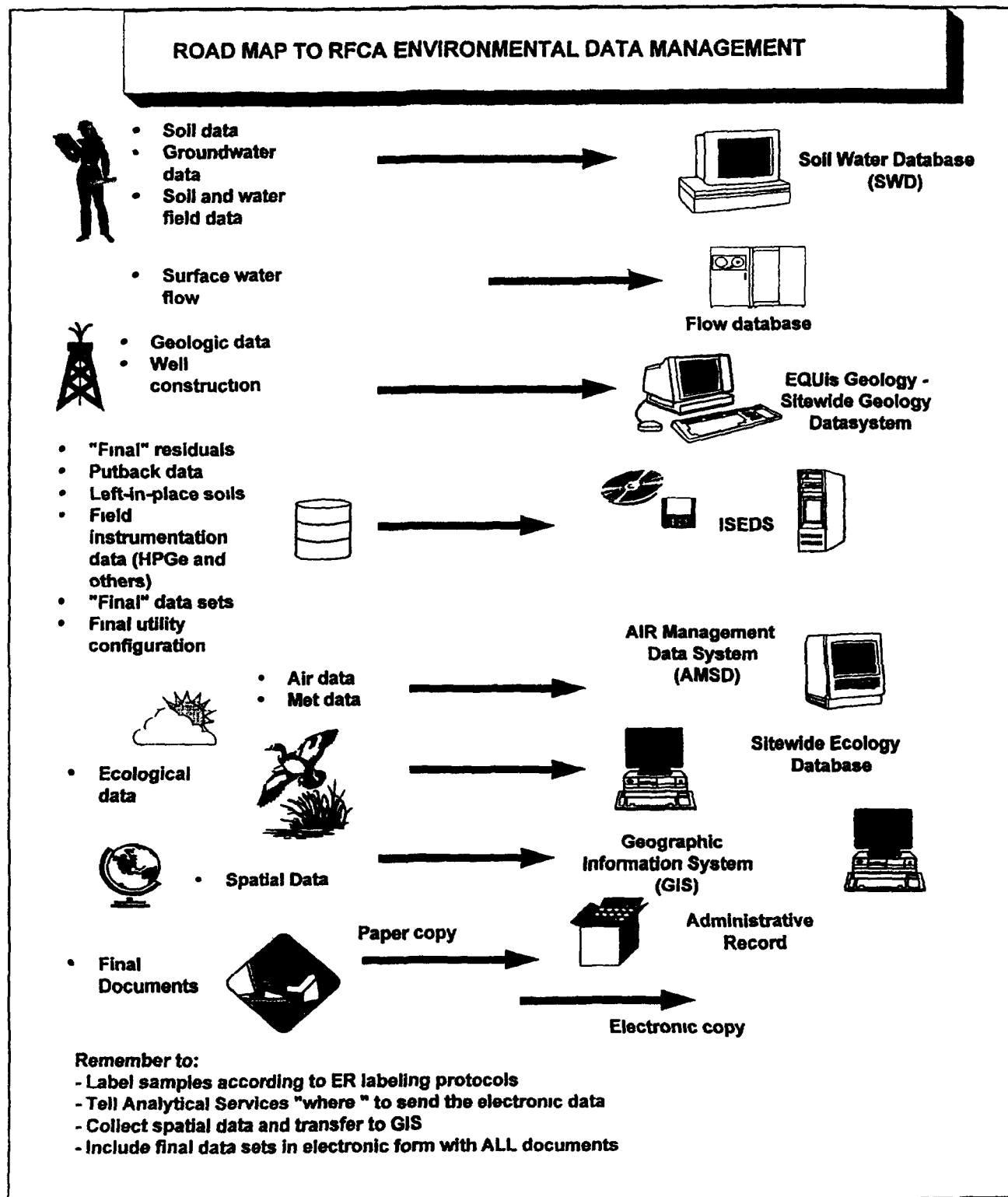


Figure F-3 Road Map to RFCA Environmental Data Management

- **Interpreted Data files** - Each project generates a set of SME- interpreted data to justify the decision Effective immediately, each project is required to include with each final decision document a copy of the interpreted data set in electronic form Final interpreted data sets include all spatial data associated with a project This will ensure that regardless of data management practices, the Site will possess the appropriate data to prepare the CAD/ROD Kaiser-Hill managers will not consider a document "complete" without the attached electronic data file
- **"Raw" Soil, groundwater, and surface water analytical data** - all analytical data collected to support ER projects will be entered into the Soil Water Database (SWD)
- **Soil and groundwater field Data** - all soil and groundwater field data collected to support ER projects will be entered into the SWD
- **Surface water flow data** - all surface water flow data will be transferred to the FLOW database - contact Marian Carr x4488
- **HpGe data and other field instrument data**- all electronically generated HpGE data and other field instrument data to support site characterization are to be stored in ISEDS, contact Marian Carr x 4488
- **Air data** - all air data (including field parameters) will be transferred to the Air Management System Database (AMSD) database - contact Carol Patnoe x 2440
- **Geologic and well construction data** - all geologic and well construction data will be transferred to RMRS, Steve Singer x 3387, for inclusion in the Sitewide EQUIS geologic data base.
- **Spatial Data (GPS)** - projects will collect appropriate spatial data for all important samples during characterization, remediation and closure At a minimum, all "final characterization" data of any residuals left on Site, will be identified by both a spatial coordinate (X,Y,Z) and a standard location name in accordance with ER location naming conventions Spatial data will be managed in coordination with the processes and procedures established by the RMRS GIS system (Wendell Cheeks x 7707)
- **Verification Soil Sampling** - Any verification soil sampling collected to demonstrate the satisfaction of performance objectives will be formally transferred for incorporation into Integrated Sitewide environmental data system (ISEDS) Similarly, where treated or untreated soil has been stockpiled and sampled prior to returning the soil to an excavated location (putback), any sample results representative of the stockpile, and thus representative of the returned soil, must be identified and incorporated into ISEDS Project managers are responsible for providing sufficient information on each data set including accurate location information and data quality information **Verification soil sampling data sets are vital to the final**

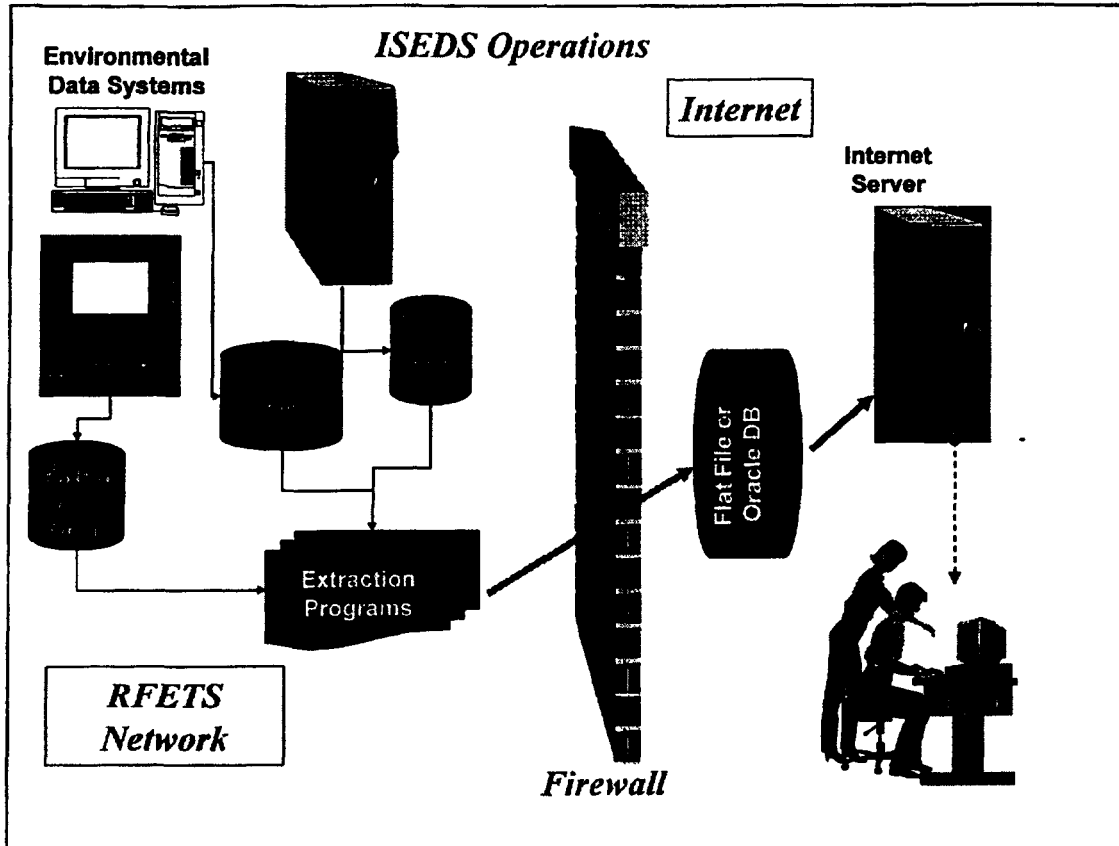
**CAD/ROD and improper management of these data can lead to both delayed closure and increased costs in the out-years**

- **Stockpile Sampling** - Where treated or untreated soil has been stockpiled and sampled prior to returning the soil to an excavated location (putback), any sample results representative of the stockpile and thus representative of the returned soils, must be placed in the SWD database. Similarly, where treated or untreated soil has been stockpiled and sampled prior to management in a location different from the excavated location, any sample results representative of the stockpile, and thus representative of the soil at the new location, must be included in SWD with the new location information
- **D&D Characterization Data** - to be managed by the D&D program in accordance with established procedures
- **Ecological Data** - all ecological data are to be managed in the Site Ecology database - contact Steve Nesta x 6386

### **1.3 Public Dissemination of Environmental Data**

During FY99, data specified in the IMP will be provided to regulators as requested. To support this data transfer effort, the Integrated Site-wide Environmental Data System (ISEDS) and the Environmental Data Dynamic Information Exchange (EDDIE) were developed. A simplified overview of ISEDS/EDDIE operations is shown on Figure F-4.

All projects collecting and reporting data collected as part of the IMP, including Special Projects, are required to provide final documents and deliverables in electronic form (both text and final data sets) to the EDDIE administrator (x4488) for posting on EDDIE or data storage in ISEDS. Regulators will be able to obtain environmental data sets on ISEDS while public stakeholders will be able to access and download approved environmental reports from EDDIE via the world wide web. All submissions can be made via email.



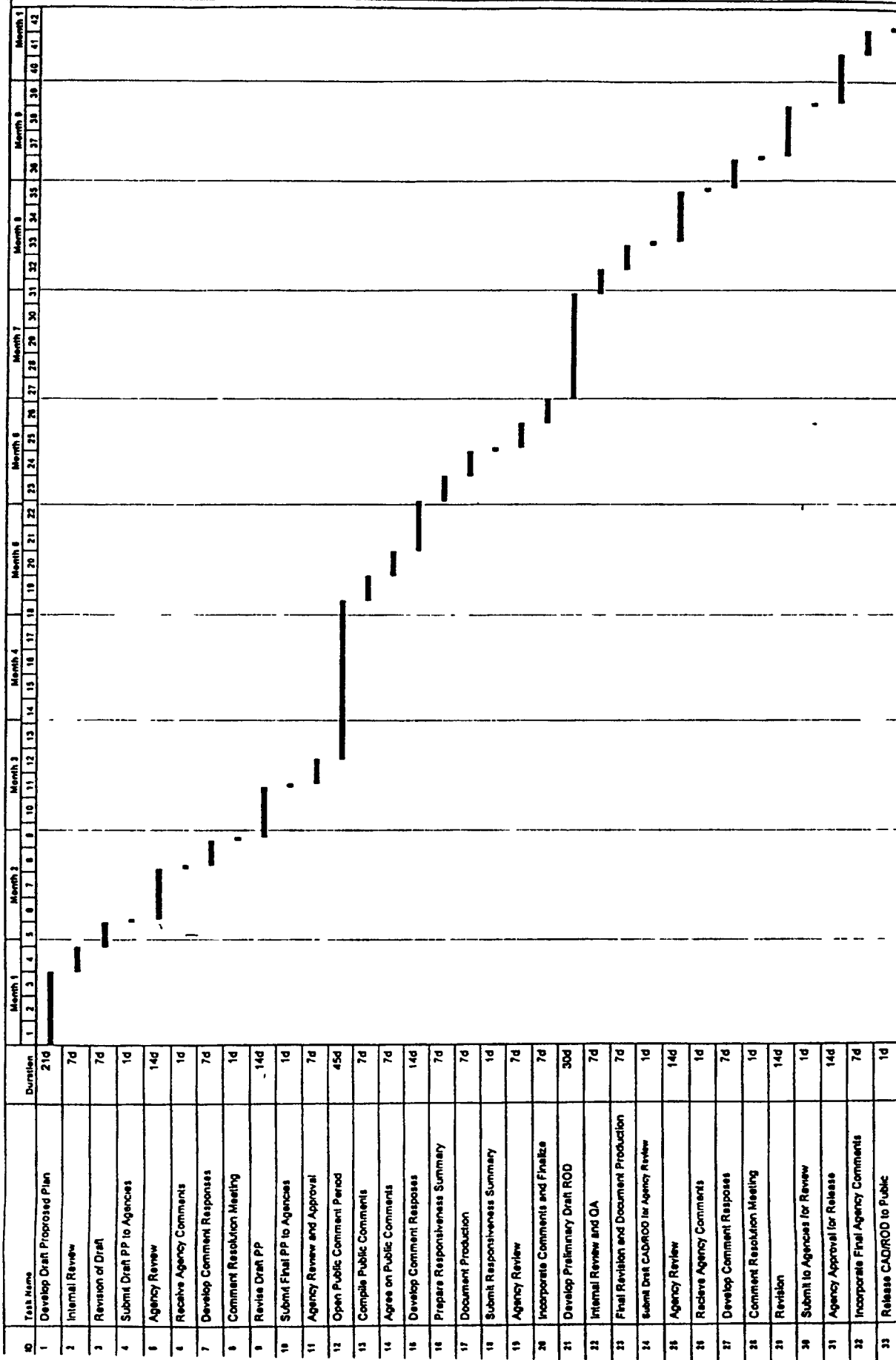
**Figure F-4 Overview of ISEDS/EDDIE Operations**

## **APPENDIX G**

### **1.0 PROPOSED PLAN AND CAD/ROD SCHEDULE**

Appendix F includes a generic schedule for the development of a PP/CAD/ROD. While actual activity durations may vary according to the complexity of the IHSS, this schedule may be used for planning purposes.

GENERIC CAD/ROD SCHEDULE



## **APPENDIX H**

### **1.0 GENERIC RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION SCHEDULE**

#### **Contents**

The contents of an RFI/RI Report may include, but is not limited to the following

- Description of the IHSS
- A summary of all field activities
- Presentation of all field data
- Location and characteristics and source(s) of contamination
- Definition on nature, extent, fate, and transport of contaminants
- Identification of sources which impact surface water
- Evaluation of risks

A generic schedule for the development of an RFI/RI Report is included. While actual activity durations may vary according to the complexity of the IHSSs, this schedule may be used for planning purposes.



## **APPENDIX I**

### **1.0 OUTLINE OF SAMPLING AND ANALYSIS PLAN**

The following SAP outline is based on *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA* (EPA, 1988a) and reflects current RFETS usage. Each SAP will vary, however, depending on the data and sample requirements, SAPs will generally include information on the following topics:

- Background information
- Sampling rationale
- DQOs
- Sampling activities and methodology
- Data management
- Project organization
- Health and Safety Plan
- Quality Assurance
- Schedule

These outline topics are described in the following sections:

### **2.0 INTRODUCTION**

The introduction will provide a brief project background and description including:

- Purpose/objectives of the SAP
- History of the site to be sampled (identify IHSSs, PACs or RCRA units in the area)
- Summary of existing data with an assessment of its adequacy
- Description of the Project including planned field activities
- Hydrogeologic setting (if appropriate to the project)

### **3 0 BACKGROUND INFORMATION AND SAMPLING RATIONALE**

This section will discuss the reasons and justification used to develop sampling factors such as number of samples, location, depths, frequency, COCs, and analytical methods. Conditions of the physical setting which influence these factors can also be discussed.

This section should typically include a brief conceptual model to identify and document the potential field conditions, factors that may impact sampling results, and potential for free product to be present. The conceptual model is intended to show how the site works physically and chemically in terms of expected conditions. The model may be presented as cross-section of the contaminant distribution and potential transport mechanisms or items, structures, and physical conditions that may impact the project (e.g., presence of drums, depth to bedrock, depth to groundwater, steep slopes, location of surface water).

#### **4.0 DATA QUALITY OBJECTIVES**

The DQO process, as described in Section 3.2, is a structured decision-making process that requires the identification of and agreement on decisions for which data are required. The process results in the full set of specifications needed to develop a protective and compliance sampling program (i.e., qualitative and quantitative statements that specify the type, quality, and quantity of the data required to support decision making). The formal DQO process is documented in two EPA documents (EPA, 1993, EPA, 1994). Specific steps in the DQO process include:

- Identify and define problem(s) to be solved
- Identify decision(s) to be made relative to the problem
- Identify inputs to the decision (data needed to make decision)
- Define study boundaries/scope of problem and decision
- Develop decision rule(s) [IF/THEN action statement(s)]
- Specify limits on decision errors (acceptable types and degrees of uncertainty)
- Develop and optimize design for obtaining data

These steps are described below.

##### **4.1 The Problem**

*Implementation of a sampling plan requires identification and disposition of contaminated media, materials, and equipment that were produced in past processes, especially relative to free*

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release (of materials) or management of particular waste types or streams Adequate samples must be taken to properly characterize and manage the materials and/or equipment, whether it is waste or not

Other decisions or subdecisions that support final project actions may be put forth in the form of following questions, provided that the answers or conclusions relate directly to project decisions, e g

- Why perform this characterization
- What is the final disposition of the material, equipment, facility, or structure (free release, restricted use, low level waste, etc )

#### **4.2 The Decisions**

The critical technical decisions for a typical project are as follows, understanding that decisions may vary relative to goals of the project

- What materials (e g , paint, concrete, pipe insulation, etc), media (e g , soil, water, oil, solid, sludge, etc), or equipment within the facility or area are contaminated or, conversely, not contaminated
- What are the generic classification categories by which the materials, equipment, and/or media will be managed, relative to an eventual assignment as contaminated (hazardous, radiological, or mixed) or not contaminated (nonhazardous)? In other words, what are the categories of waste streams that will result from the activity? What are the ultimate dispositions (i e , waste classifications and treatment, storage, and disposal [TSD] facilities) of the waste streams, including quantities (e g., a completed summary table)

#### **4.3 Inputs to the Decisions**

Inputs to the decisions are data, both qualitative and quantitative Qualitative information will typically consist of nominal data (e g , paint color, texture, or equipment type, etc) derived from visual observation of the building's equipment and materials Quantitative data may be produced from analytical, radiochemistry, radiation surveys or petrographic analysis (asbestos) of samples Waste Acceptance Criteria (WAC) are typically the drivers for decision inputs where data will be used to characterize waste streams destined for a particular TSD facility (e g , NTS, Envirocare or USA waste) Inputs to the decisions are COC-specific

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Inputs to the decision must also include, directly or in other subsections, the following

- Analytical/radiochemistry results
- Radiation survey results
- Method-specific sensitivities (detection limits or minimum detectable activities)
- Error tolerances associated with the measurements (e g , accuracy and precision)
- Action levels (regulatory thresholds)

Although professional judgment is instrumental, sampling must err to the conservative (i e , collecting more samples) if there is any doubt regarding homogeneity of the materials sampled

Other decisions or subdecisions that support final project actions may be put forth in the form of following questions, provided that the answers or conclusions relate directly to project decisions

- What information is required to make this decision
- What source(s) can be used to obtain the information
- Can the desired analysis be done at RFETS or will the samples be shipped off-site for analysis
- What types and kind of sampling measurements are required
- What type of instrumentation is required
- Has facility structural data been reviewed
- What suspect materials have been identified
- What are the required instrumentation sensitivities
- What method will be used to obtain the desired information
- What Quality Assurance (QA) program requirements are there for these samples  
—(i e , blanks, duplicates)
- What number of samples/measurements will provide the desired certainty
- Have data quantity and quality control requirements for sampling been reviewed

#### **4 4 Project Boundaries**

Project boundaries describe the geographic, three-dimensional areas, and temporal boundaries of the characterization activity Other decisions or subdecisions that support final project actions may be put forth in the form of following questions, provided that the answers or conclusions relate directly to project decisions

- What is the sample population of interest
- Are there any constraints on data collection

#### **4.5 Decision Rules and Error Limits**

Decision rules must be based on objective, reproducible, and verifiable, measurable criteria. If the decision is statistically based, decision error must address both the producer's (alpha) error and the consumer's (beta) error. "False Positive" error is usually equivalent to the alpha error while the "false negative" is equivalent with beta error, although this determination hinges on the way in which the hypothesis test is setup. Alpha and beta error typically range from 1% to 10% (i.e., confidences from 99% to 90%, respectively), based on standard statistical practice and historical acceptance by the regulators (public, CDPHE, and EPA Region VIII).

Decisions may also be based directly on protocols promulgated by the regulators, for example determination of asbestos. Other decisions or subdecisions that support final project actions may be put forth in the form of the following questions, provided that the answers or conclusions relate directly to project decisions.

- What is the basis for the decision
- Are there any regulatory and statistical drivers for sampling frequency
- What action levels are applicable to the discussion or parameter of interest
- Define the discussions using "If then" statements (e.g. if paint containing >50 ppm PCBs is identified then all resulting waste material will be handled as TSCA waste)

#### **4.6 Optimization of Design**

Modifications to the DQOs are typically based on visual observations, new information revealing data gaps as the project progresses, and professional judgement, all of which are documented and are discussed in the Data Quality Analysis section of the final report.

Acquisition of a sample directly depends on the sampling team's observations of the material, equipment, equipment components, or media of interest. If data gaps are identified subsequent to the characterization sampling and decisions described herein (i.e., the decision can not be made with confidence), additional sampling of source materials and/or waste streams will be conducted.

Analytical data collected in support of specific projects will be evaluated using the guidance established by the Rocky Flats Administrative Procedure 2-G32-ER-ADM-08 02, *Evaluation of ERM Data for Usability in Final Reports (RMRS 1994e)*. This procedure establishes the guidelines for evaluating analytical data with respect to PARCC parameters. Data validation will be performed according to the RFETS, Analytical Services Division (ASD) procedures and will be done after the data are used for their intended purpose.

## 5.0 SAMPLING ACTIVITIES AND METHODOLOGY

This section describes what information sampling methodology and the locations. Figures may be provided in the SAP for clarity, and available information may be presented about the samples, including

- Number of samples in each media
- Grid spacing or sample location
- Sample depths
- Criteria for selection of additional samples
- Sample numbering
- Type and frequency of QA/QC samples
- Sample analysis (method numbers)

For each medium, describe the above information in the text and, as appropriate, provide a table enumerating the samples to be collected, rationale for each sample, analysis method (and method number), amount and types of QC samples, the type of container, preservative, and holding time. These tables should include project requirements and collection locations, where appropriate. The overall QA/QC requirements including field duplicates and blank samples analytical detection limits, and standards for accuracy and completeness are provided in the IMP. Sample handling, including chain-of-custody and packaging procedures, should be performed according to ER procedure 4-B29-ER-OPS-FO 13 *Containerization, Preserving, Handling and Shipping of Soil and Water Samples (RMRS, 1994c)*.

This section should briefly describe how samples will be numbered and labeled in the field. Sample numbers are assigned by the SWD or ASD. It is strongly recommended that sample numbers be obtained from SWD and included in the SAP. Numbers from the assigned block of samples will be assigned if additional samples are needed. If only field-screening data will be collected, describe a systematic method that will be used to number sample locations, depths and analytical results.

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## **6.0 DATA MANAGEMENT**

A project field logbook should be created and maintained by the project manager or designee in accordance with site Procedures 2-S47 ER-ADM-05 14, *Use of Field Logbooks and Forms (RMRS 1995b)* and 4-B29-ER-OPS-FO 14 *Field Data Management (RMRS, 1994d)*. The logbook should include time and date of all field activities, sketch maps of sample locations, or any additional information not specifically required by the SAP. The originator should legibly sign and date each completed original hard copy of data. Appropriate field data forms should also be utilized when required by operating procedures that govern the field activity. Sample designations will appear in the logbook and on the field data forms. A peer reviewer should examine each completed original hard copy of data. Any modifications will be indicated in ink, and initialed and dated by the reviewer. Logbooks will be controlled through RMRS Document Control.

Analytical data record storage for this project will be performed by ASD. Sample analytical results will be delivered directly from the laboratory to the APO in an Electronic Data Deliverable (EDD) format and archived in the SWD. Hard copy records of laboratory results will be obtained from the APO in the event that the analytical data is unavailable in EDD or SWD at the time of report preparation. Analytical results will be compiled into a sampling and analysis results report. Additional data management discussion is provided in Section 3.4 of the main text.

## **7.0 PROJECT ORGANIZATION**

If the SAP is not part of a document which already includes a project organization section, it should be described here. An organization chart should be included, at a minimum, that will include the project manager, sample team lead, and the appropriate quality assurance and safety personnel.

## **8.0 HEALTH AND SAFETY PLAN**

The HASP used to control work should be referenced. In addition to the site-wide HASP, a project-specific HASP will usually have been developed for the PAM or IM/IRA being implemented. If only sampling activities are to be performed, a separate HASP may be needed to cover the activity.

## **9.0 QUALITY ASSURANCE**

This section is based on implementing the site-wide Quality Assurance Project Plan to address the project-specific quality requirements, including the following elements

- The 10 DOE quality criteria (Per DOE Order 5700 6C or 10 CFR 830 120) and including relevant parts of ANSI/ASQC E4 as applicable
- Sampling method, including specialized or specific equipment or instrumentation
- Collecting Decision logic for fewer or greater numbers of samples than those specified in the SAP
- QC sample types and quantities
- Specific analytical and/or radiochemistry methods and method numbers (e g , SW-846, ASTM, (ANSI) American National Standards Institute, (ASQC) American Society of Quality Control, (ASTM) American Society of Testing and Material, etc)
- Sample management requirements, including preservation, chain of custody, and shipping
- Data management and reduction requirements, including hardcopies and digital data (See Appendix F, Environmental Data Management )
- Modeling of software/hardware verification/validation

## **10.0 REFERENCES**

Provide the references used to generate the SAP, if appropriate This will include documents used to develop the background and site descriptions

## **APPENDIX J**

### **1.0 CORRECTIVE MEASURES STUDY/FEASIBILITY STUDY PREPARATION**

The CMS/FS report summarizes the results of the RFI/RI and the baseline risk assessment. Based upon that summary, risk and ARARs-based narrative remedial action objectives and where appropriate numeric remedial action goals are developed. Based upon the statement of objectives and goals, technologies are identified and evaluated for feasibility, screened against the criteria enumerated in the NCP, and ultimately compared one against another.

A suggested outline for the development of the CMS/FS is discussed in the following sections. It must be understood that the remedial action objectives control the types of technologies and process options considered.

The sections of a CMS/FS include:

- Executive Summary
- Introduction
- Site Characteristics
- Corrective/Remedial Action Objectives
- Identification and Screening of Alternatives
- Detailed Analysis of Alternatives
- Selected Alternative (Optional)

### **1.1 EXECUTIVE SUMMARY**

The Executive Summary outlines the site characteristic, risk factors, and ARARs considerations essential to developing the remedial action objectives and then clearly presents the remedial action objectives. The processes and factors that proved crucial to identifying and framing alternatives are then highlighted and followed by a comparison of each alternative to the nine criteria. The selected alternative may then be presented with further discussion of relevant factors that demonstrate satisfaction of the criteria.

## **1.2 INTRODUCTION**

The introduction provides information as to the framework to which the CMS/FS is being prepared, a list of acronyms and an outline of each section of the report

## **1.3 SITE CHARACTERISTICS**

This section describes the nature and history of the contamination source(s)

## **1.4 CORRECTIVE/REMEDIAL ACTION OBJECTIVES**

This section summarizes the risk assessment, provides an overview of location and action specific ARARs, and defines chemical specific ARARs. The risk assessment results and ARARs are then used to develop narrative remedial action objectives, and, where appropriate, numeric remedial action goals

## **1.5 IDENTIFICATION AND SCREENING OF ALTERNATIVES**

Based upon the narrative remedial action objectives and numeric remedial action goals, remedial technologies and process options are first identified and screened. The remedial technologies and process options are then assembled into alternatives, and screened as to effectiveness, implementability, and relative cost

## **1.6 DETAILED ANALYSIS OF ALTERNATIVES**

The alternatives which are retained following the screening are now further refined as to technical detail and cost. The refined alternatives are then evaluated against the nine evaluation criteria

- Overall protection of human health and the environment
- Attainment of ARARs
- Long-term protectiveness
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

## **1 7    SELECTED ALTERNATIVE**

During project scoping the stakeholders will determine if the selected alternate and analysis leading to the selected alternative is provided in the CMS/FS or under separate cover. The section provides an analysis that makes comparisons among alternatives. The selected alternative is then further described to show how it satisfies the nine criteria.

[illegible]

Project	GENERIC CMS/FS SCHED	Task	Progress

## APPENDIX L

### SUMMARY OF RISK ASSESSMENT METHODOLOGY FOR RFETS

#### 1 0 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

A site-specific HHRAM was developed that differs from standard CERCLA guidance in some respects. The methodology has been documented in the *draft Human Health Risk Assessment Methodology for RFETS* (DOE, 1995b). The risk assessment methodology also includes the conservative screen, developed by the CDPHE and agreed to by the DOE, to ensure that the requirements of the RCRA are met. Several risk assessments for former OUs have been produced using this methodology. In the future, it is likely that it will be used for screening level risk assessment and as the basis for the CRA.

The HHRAM process, including the conservative screen, is shown in Figure N-1. Each step in the HHRAM process is done in consultation with the agencies and documented by a technical memorandum. Step 1 is the evaluation of data to determine if sufficient data of appropriate quality are available to perform a risk assessment or screen. Step 2 is the selection of potential chemicals of concern (PCOCs). Site data for inorganics and radionuclides have been compared to background values, using a battery of statistical test designed by Gilbert (1992), and accepted for use at RFETS by the DOE and the agencies. If the analyte was indicated to be above background by any of the tests it was considered a PCOC. This is a time consuming, costly, and statistically unsound (increased probability of a Type I error) process. For future risk assessments the Gilbert methodology will be treated as a statistical toolbox. The most appropriate test will be selected from the Gilbert toolbox for each analyte (inorganics and radionuclides) that has a maximum concentration greater than the background mean plus two standard deviations (M2SD). The selection of the statistical test will be a balance of the data characteristics (e.g., number of nondetects, distribution of data) of the analyte. A description of the statistical tests and their use is given in Attachment 1. All detected organics are considered to be PCOCs.

The RFCA changed the emphasis for environmental remediation to investigation, evaluation, and remediation of IHSSs and AOCs, instead of an OU-by-OU basis. The PCOC selection process will likely be applied to a particular source or associated sources grouped as an AOC. Fewer samples may be available for statistical analysis due to the change in emphasis to source areas. It will be very important that a sufficient number of samples be available for application of the Gilbert toolbox. After the determination of PCOCs, the conservative screen is applied to the data and the baseline risk assessment may be started.

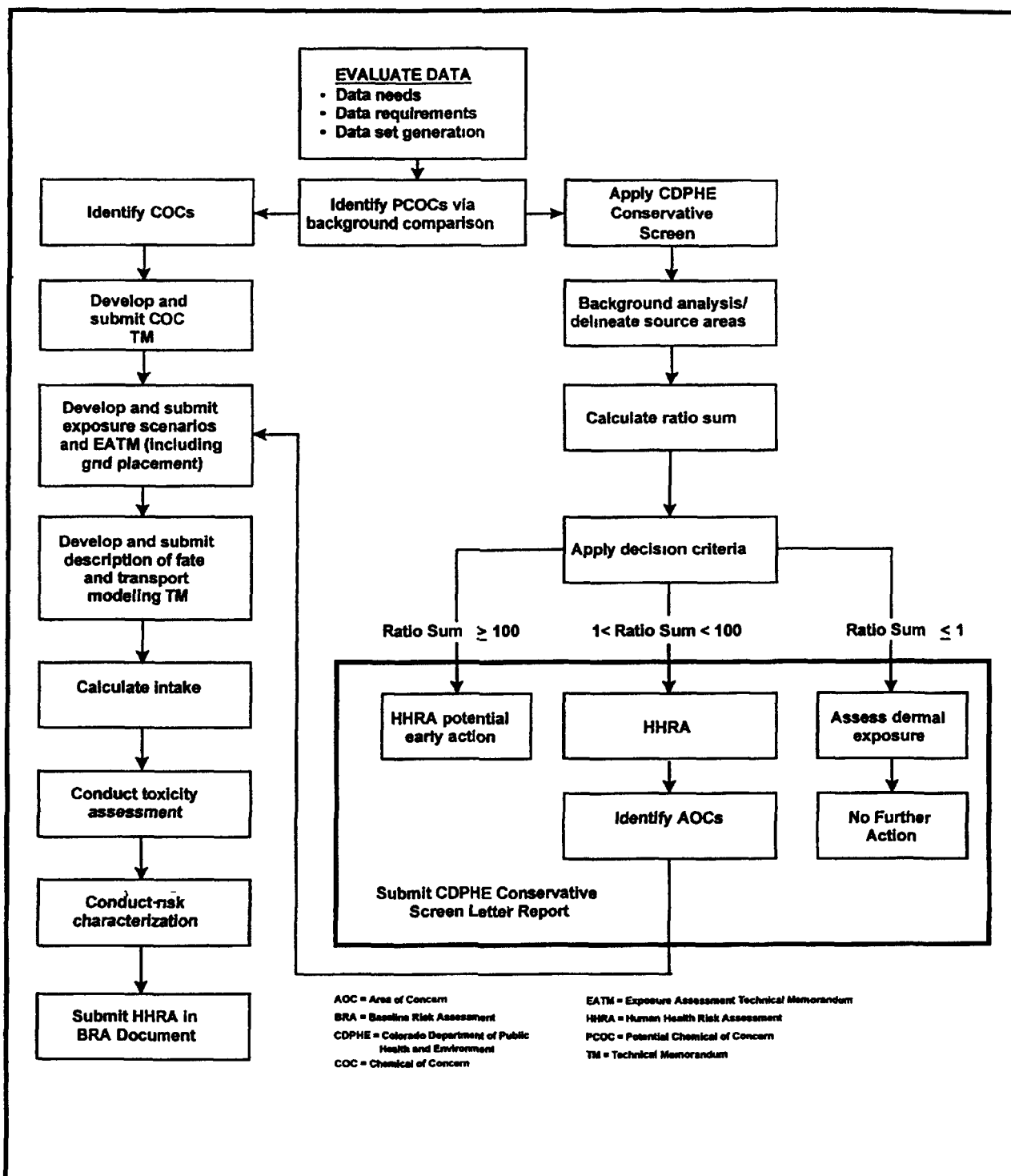


Figure L-1 Human Health Risk Assessment Methodology

## **1.1 CONSERVATIVE SCREEN**

The conservative screen has been accepted for use at the RFETS (DOE, 1994a). The purpose of the conservative screen is to help determine if a particular site is a candidate for no action, accelerated action, or further evaluation through the BRA process. The conservative screen is the basis of the NFA decision criteria presented in Attachment 6 of RFCA. A site that passes the conservative screen is a candidate for NFA status and free release with no land use restrictions.

The screen also provides methodologies for identifying source areas and grouping them into AOCs. The process is shown in Figure N-2. The conservative screen uses the residential PPRGs to calculate the ratios used in the decision criteria (DOE, 1995a). A letter report is submitted to the agencies to document the results.

## **1.2 CHEMICALS OF CONCERN**

The next step in the HHRAM process is the selection of COCs. The selection process, as agreed to by the DOE and the agencies, is shown in Figure N-3.

The COCs have been selected on an OU-wide basis and then applied to each AOC within the OU. Now COC selection will often be done for single sources or sources grouped as an AOC as a result of an action level screen. It is very important that sufficient data be available for this analysis. The COC selection process for the CRA should be based on the present methodology, with COCs selected separately for the two site OUs (Buffer Zone and Industrial Area). The COCs are selected in consultation with the agencies and a TM is submitted to document the results.

## **1.3 EXPOSURE SCENARIOS AND PARAMETERS**

Exposure scenarios and associated exposure factors, developed during negotiations among the DOE, the EPA, and the CDPHE, were transmitted to the agencies in June 1995 (DOE, 1995b). The exposure factors have been used in several BRAs for specific OUs (OUs 2, 3, 4, 5, and 6). The EPA and the CDPHE have accepted all of the exposure factors with the exception of the fraction ingested from contaminated source for the central tendency residential exposure by soil ingestion and the chemical-specific values for the soil ingestion matrix effect (EPA/CDPHE, 1995). Chemical specific soil ingestion matrix values must be submitted to the agencies for approval before being used.

The two exposure scenarios to be used in the CRA to evaluate the on-Site risks and hazards to human health from environmental contamination under the RFCA will be the open-space recreational receptor for the BZ and the office worker for the IA. Off-Site risks and Hazards will be evaluated using the residential scenario. Other scenarios may be evaluated in the CRA if agreed to by the DOE, EPA, and CDPHE.

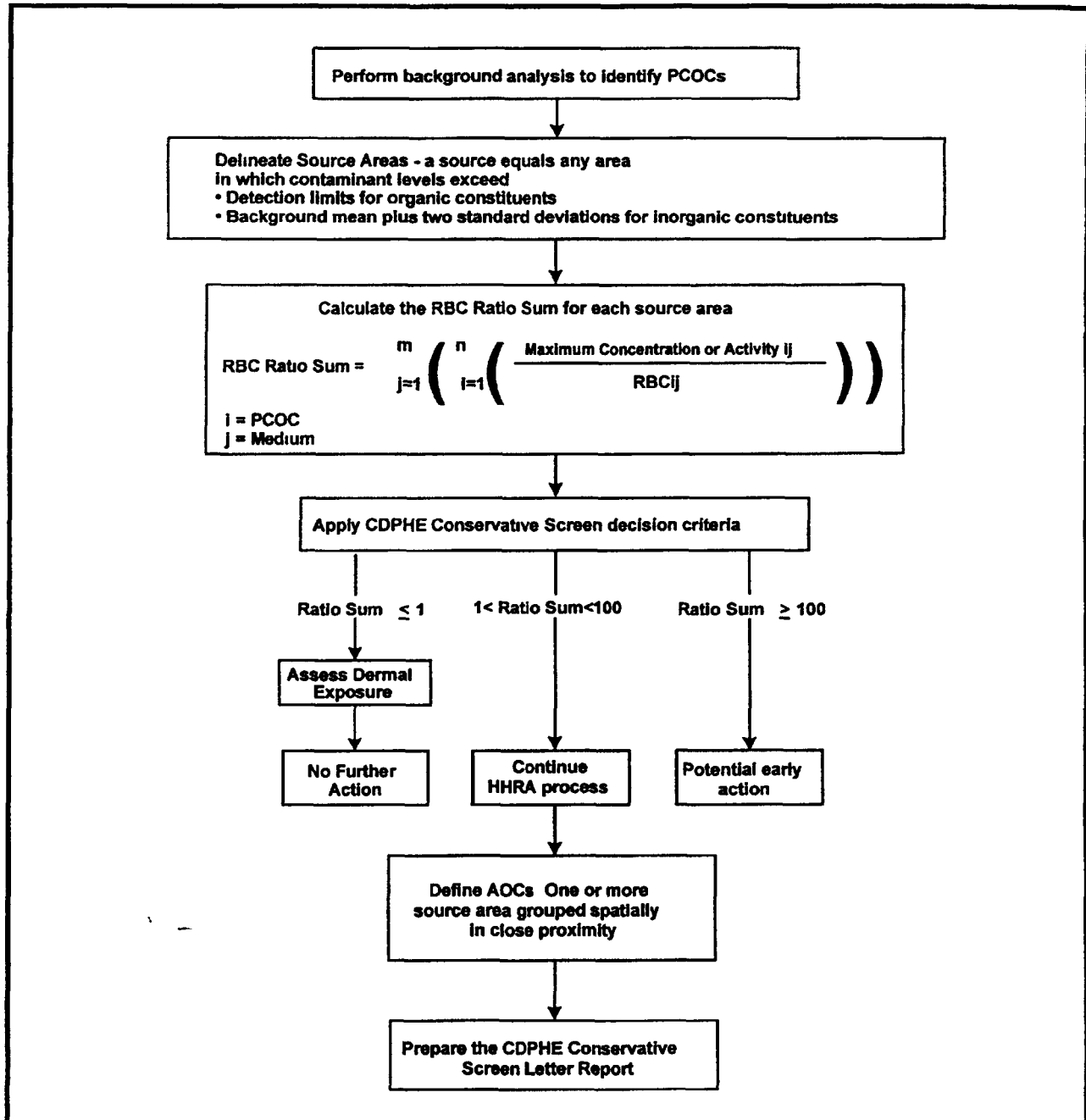


Figure L-2 CDPHE Conservative Screen

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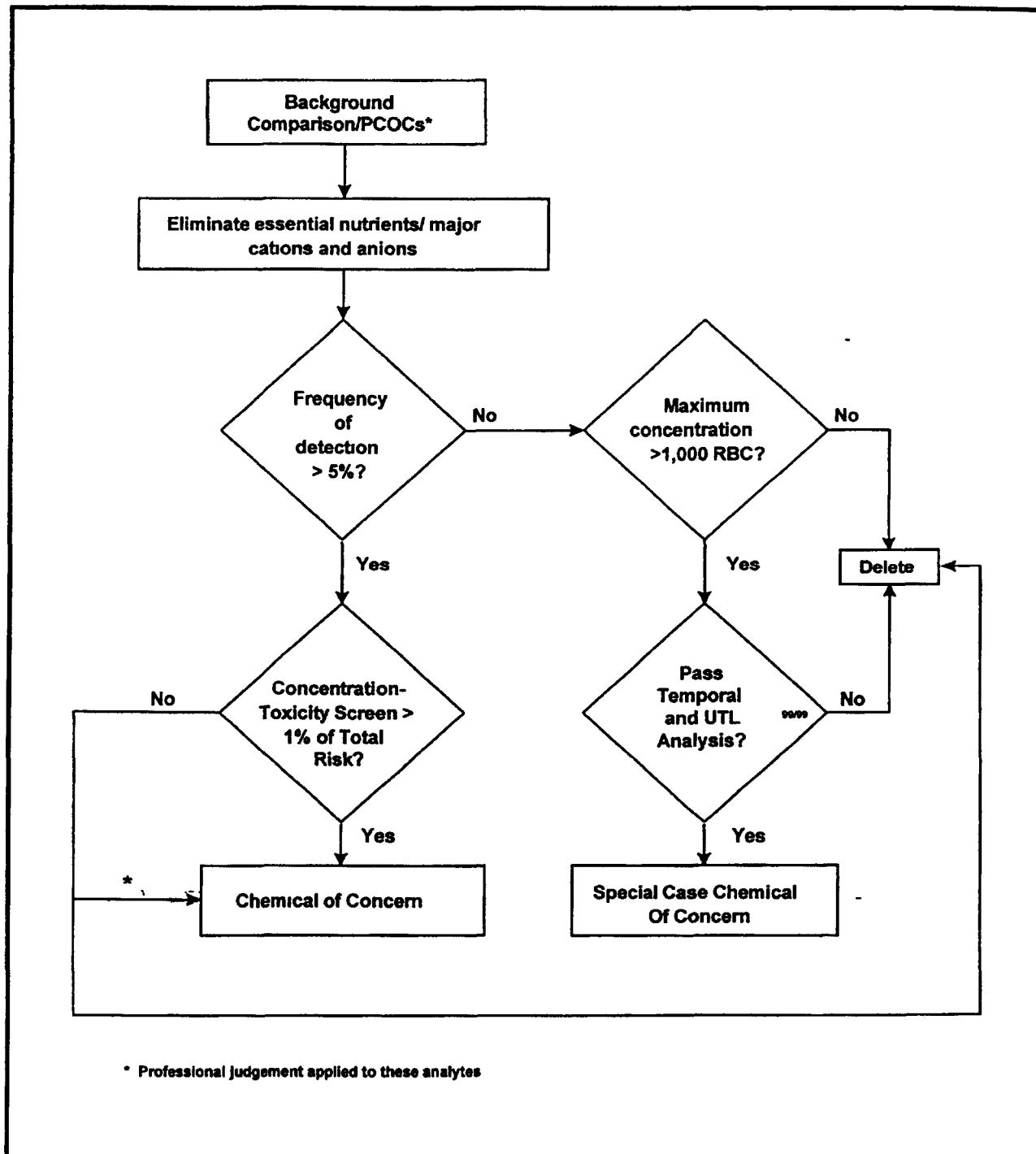


Figure L-3 Chemical of Concern Identification

## 1.4 RISK CHARACTERIZATION

Exposure concentrations and risks will be calculated in accordance with EPA guidance (EPA, 1989a) as documented in the HHRAM (DOE, 1995b). Both radiological risk and dose will be estimated. Radiological doses will be calculated using methods and parameters employed for development of the ALF.

## 1.5 ECOLOGICAL RISK ASSESSMENT

Protection of ecological as well as human receptors is a central goal under CERCLA and the RFCA. The methodology for quantifying possible adverse effects to ecological receptors is similar to that for human receptors. A sitewide ERAM was developed that is consistent with the EPA's eight-step guidance (draft) on conducting ERAs at Superfund sites (EPA, 1994b). This methodology has been used for ecological risk assessments for the Walnut Creek and Woman Creek watersheds at RFETS (DOE, 1996c). The screening portion of this site-specific guidance is shown in Figure N-4 as described in the following documents:

- *ERAM Technical Memorandum, Sitewide Conceptual Model* (DOE, 1996a) helps identify environmental stressors and the potentially complete exposure pathways that will become the focus of the ERA.
- *ERAM Technical Memorandum, Ecological Chemicals of Concern Screening Methodology* (DOE, 1996b) describes a tiered screening process for identifying chemicals at potentially ecotoxic concentrations.

The purpose of a screening-level ERA is to detect whether a significant ecological threat exists in a geographic area. After PCOCs have been determined for a geographic area, risks are estimated by comparing maximum analyte concentrations with screening-level ecotoxicity benchmarks, with the subsequent generation of hazard quotient (HQ) values. The HQ is the result of the exposure estimate divided by the benchmark. This step is used to evaluate whether the preliminary screening is adequate to determine the presence of an ecological threat. If none of the PCOCs are present at ecotoxic concentrations, the site is considered to present a negligible or de minimis risk and a more detailed quantitative risk assessment is not warranted (EPA, 1994b). If a given IHSS or source area fails to pass the ERA screen ( $HQ > 1$  for any analyte), the data are evaluated in more detail. This includes a much more comprehensive evaluation of exposure pathways and a more accurate method for estimating exposure than a screening-level ERA. The exposure estimation includes methods that account for factors which modify the frequency, duration, and intensity of contact between a receptor and the contaminated media. This evaluation results in a list of chemicals that are subjected to more detailed analysis in the ecological risk characterization.

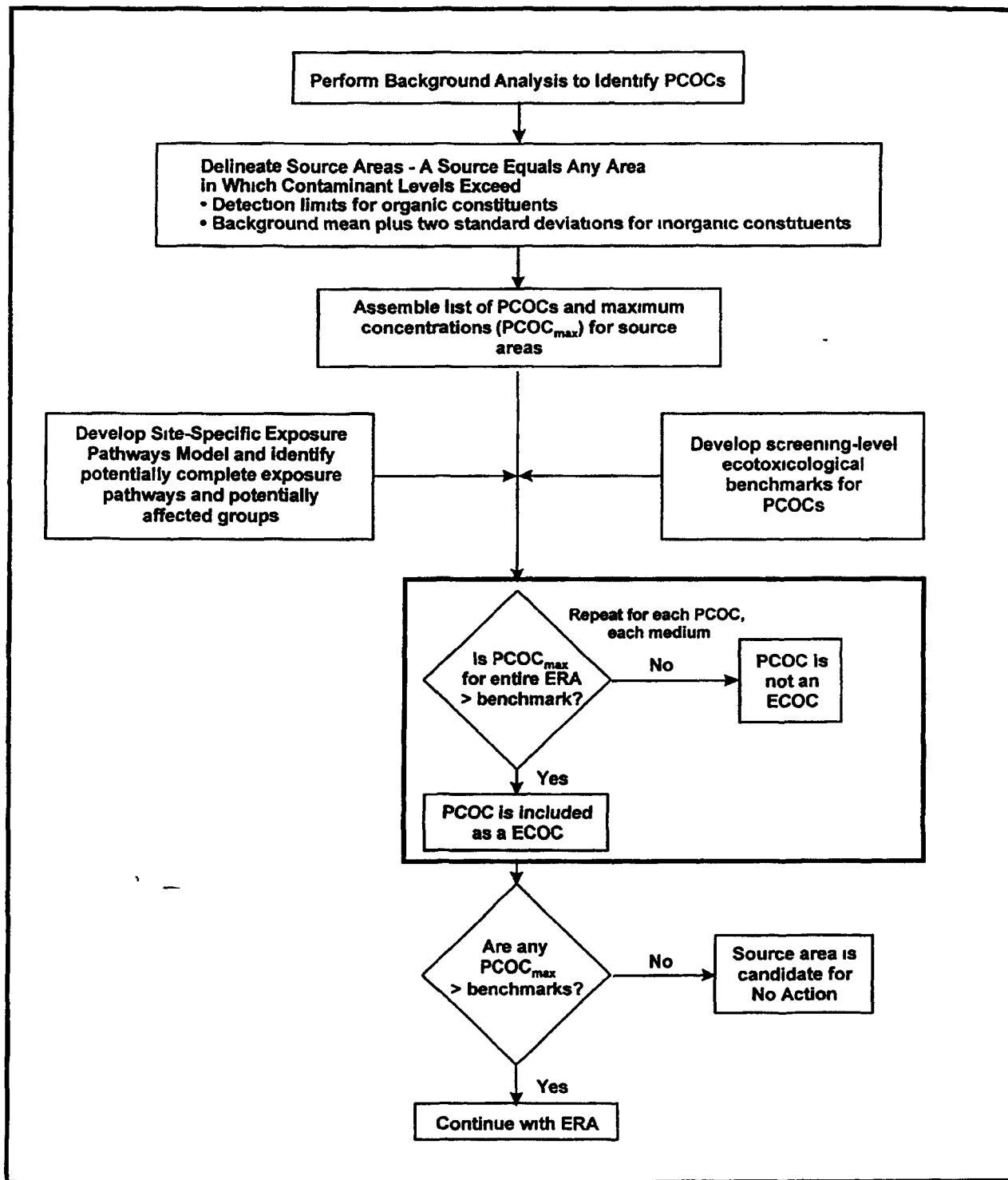


Figure L-4 Screening-Level ERA

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The characterization in the ERA integrates the exposure assessment and the effects assessment. It includes a description of risk in terms of the assessment endpoints, a discussion of the ecological significance of the effects, a summary of the overall confidence in the ERA, and a discussion of possible risk management strategies. The ERA performed for the Walnut Creek and Woman Creek watersheds will form the basis for the Ecological component of the CRA (DOE, 1996c).

## ATTACHMENT 1

### BACKGROUND COMPARISON (Adapted from Chromec et al., 1995)

Analytical results for metals, radionuclides, water-quality parameters, and selected organics, if appropriate, are compared to the chosen background data using one of the following five statistical tests:

**Lognormal Upper Tolerance Level (UTL99/99)** Each result is compared to the background 99% UTL on the 99th percentile of background. This hot measurement test assures that no hot spots in an area of concern are overlooked. If one or more measurements exceed the UTL99/99, the analyte is considered a PCOC pending application of professional judgment. UTLs cannot be reliably calculated for analytes with a very high rate (>80%) of nondetects.

**The Slippage Test** This is a rapid screening test. The Slippage test is a nonparametric test and can be used for all data distributions. The test should not be used if the highest value in the data set is a nondetect. If the number of site measurements that exceed the background maximum value are greater than a critical number obtained from the appropriate table, then the analyte may be a PCOC.

**The Quantile Test** This is also a rapid screening, nonparametric test and can be used with all data distributions. If the number of site results that are among the largest  $r$  (number selected from a table of values) measurements exceeds a predetermined number, it may be concluded that the analyte is a PCOC. The test should only be used if there are no nondetects among the largest measurements of the combined background and site data sets. A  $p$ -value of 0.05 or less is considered to indicate a significant difference from background concentrations.

**The Gehan Test (nonparametric ANOVA)** The Gehan test is a nonparametric test that can be used when multiple detection levels are present. It is applied without replacing nondetect values. The data are ordered, ranked and scored. A "Z" statistic is calculated and compared to values from a table at a chosen  $p$ -value. A  $p$ -value of 0.05 or less is considered to indicate a significant difference from background concentrations. Gilbert did not feel that the performance of this test had been sufficiently determined and suggested that it be evaluated at the earliest possible time.

**The Student's  $t$  Test** This is a common parametric test for determining if the means of two populations are different. The  $t$  test is the preferred test when the background and site data are normally and independently distributed, with equal variances and no nondetects. The test is

applied on populations with at least 20 observations and less than 20% nondetects. A p-value of 0.05 or less indicates a significant difference between means.

Analytes with greater than 80% nondetects cannot be compared using statistical tests and test results for analytes having 50-80% nondetects, should be reviewed with caution.

If the selected statistical test indicates a statistical difference above background levels and it has been applied appropriately, the chemical will be considered a PCOC. Professional judgment will also be used to retain or eliminate chemicals. Graphics may be used to support such decisions.

**Professional Judgment** Professional judgment is narrowly defined. It can be used to include a chemical that did not appear to be significantly different from background based on the results of the statistical test, but for which there exists a preponderance of historical data suggesting that the chemical may have been released to the environment in significant quantities. Professional judgment can also be applied to exclude a chemical for which at least one of the statistical tests was significant, but the difference from background can be explained by spatial, temporal, or pattern-recognition concepts.

Professional judgment may also determine that there was an invalid application of the statistical tests, distributional assumptions were violated or nondetect rates were so high that the statistical tests actually compared replacement values, making the test results highly suspect or meaningless. The statistical comparison of data sets where one or both data sets have high nondetect rates or high value nondetects may be an invalid use of the statistical tests (Gilbert and Simpson 1992). For RFETS, various reports (DOE 1993a, 1994, and others) have used 80 percent as the cut-off value for nondetects. However, there is inherent uncertainty in statistical test results that are produced using data sets with greater than 50 percent nondetects.

Other potential pitfalls in the application of statistical tests include violation of distributional assumptions, variance assumptions, data independence assumptions. If such assumptions are violated, the results of such statistical tests are suspect. If the results are accepted as valid, the PCOCs identified continue through the COC selection process.

## **APPENDIX M**

### **Action Levels for Radionuclides in Soils**

Appendix L, Action Levels for Radionuclides in Soils, provides the technical basis for the development of the enforceable action levels for radionuclides in soil as defined in Attachment 5 to the Rocky Flats Cleanup Agreement

**ACTION LEVELS FOR RADIONUCLIDES IN SOILS  
FOR THE  
ROCKY FLATS CLEANUP AGREEMENT**

**FINAL**

**US DEPARTMENT OF ENERGY  
US ENVIRONMENTAL PROTECTION AGENCY  
COLORADO DEPARTMENT OF PUBLIC HEALTH AND THE ENVIRONMENT**

**OCTOBER 31, 1996**

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## ACRONYMS

ALARA	As Low As Reasonably Achievable
ALF	Action Levels and Standards Framework for Surface Water, Ground Water and Soils
ANL	Argonne National Laboratory
CAB	Citizens Advisory Board
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
DCF	Dose Conversion Factor
DOE	US Department of Energy
EPA	US Environmental Protection Agency
GI	Gastrointestinal
ICRP	International Commission on Radiological Protection
MCL	Maximum Contaminant Level
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NRC	US Nuclear Regulatory Commission
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RME	Reasonable Maximum Exposure
SCM	Site Conceptual Model

## **EXECUTIVE SUMMARY**

### **INTRODUCTION**

During the Rocky Flats Cleanup Agreement (RFCA) negotiations, the Action Levels and Standards Framework for Surface Water, Ground Water and Soils (ALF) Working Group realized that setting soil action levels and cleanup standards for radionuclides was a complex process and could not be completed before public notice of the draft RFCA. The RFCA Attachment 5 states that "The parties commit to expeditiously convene a working group to determine the derivation and application of the 15 mrem per year level as well as the derivation and potential application of the 75 mrem per year level." This summary explains the consensus recommendation of that Working Group.

The Working Group convened in early March 1996 and was composed of personnel from the Department of Energy (DOE), the Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDPHE) and Kaiser-Hill, L L C. The Working Group agreed that its charter was to develop technically defensible standards which will not exceed the 15/75 mrem per year dose limits in ALF. The Working Group recognized that the 15/75 requirement was based on EPA's draft 40CFR196, Radiation Site Cleanup Regulations, which were intended for the release of government property. Because the RFCA preamble and the Rocky Flats Vision identify future land uses for the RFETS, which exclude release of government property and permit no residential land use, pertinent sections of the draft regulation were used as guidance for the Working Group.

Radiation dose was chosen as the primary criterion for assessing radionuclide action levels. The ALF called for the consideration of both radiation dose assessment and radiation risk assessment by the working group in making its recommendations. The use of radiation dose

to develop action levels is consistent with EPA's draft 40CFR196, Nuclear Regulatory Commission decommissioning requirement, DOE Order 5400.5, "Radiation Protection of the Public and the Environment", and DOE's proposed 10CFR834. Since these regulations are all radiation dose based, this is compelling evidence that the radiation protection community is recommending the use of radiation dose to limit environmental levels of radionuclides. In addition, the preamble to draft 40CFR196 compares the risks associated with remediation, transportation and disposal of contaminated soils against the risks of leaving contaminated soils in place at the 15/75 mrem per year dose limit. EPA concluded that the use of a 15/75 mrem dose limit to establish action levels is protective of the public. Furthermore, the dose assessment process incorporates all pertinent facets of EPA's CERCLA risk assessment process. The radionuclide working group agrees with the EPA draft regulation and is recommending the use of a radiation dose basis.

To translate the radiation dose requirements into soil action levels, it is necessary to first model radionuclide transport within the environment to a human receptor and then assess the receptor's radiation dose. The "RESRAD" computer code was chosen to model this complex process. RESRAD was specifically developed to calculate the radiation dose to an individual and also to derive action levels for radionuclides in soil. RESRAD has been verified and validated for use in assessing radioactive material in soils. An asset of the RESRAD code is its capability to assess contaminant transport to a human receptor in air, surface water, ground water and unsaturated zone soils over the 1,000 year modeling period as specified in the draft EPA regulation. This makes it possible to calculate radiation dose and action levels over any applicable exposure routes (e.g., ingestion, inhalation and external irradiation pathways) for a given receptor. RESRAD also has the capability to model multiple exposure scenarios (e.g., residential, open space and office worker) and to assess radioactive daughter products over the 1,000 year modeling period. The radionuclide working group recommends the use of RESRAD in calculating action levels for the RFETS.

## SITE CONCEPTUAL MODEL

There are two separate soil types that need to be assessed at the RFETS surface soils and subsurface soils. Surface soils are defined in the ALF from the surface to a depth of 15 cm. Consistent with the RFCA preamble and the Rocky Flats Vision, ALF specifies that surface soil action levels would be derived using an open space exposure scenario in the buffer zone and an office worker exposure scenario in the industrial area. Subsurface soils are defined in the ALF from a depth of 15 cm to the top of the ground water table. Per the ALF, subsurface soil action levels are protective of surface water standards through ground water transport of contaminants to surface water. Ground water is not considered a potential drinking water source at RFETS as prescribed in the RFCA preamble and the Rocky Flats Vision.

Per the RFCA preamble and the Rocky Flats Vision, institutional controls may be applied at RFETS. Use of institutional controls may be considered under EPA's draft 40CFR196 when releasing a site. EPA's draft regulation states that any radioactive material in surface soils shall not impart an annual radiation dose to the appropriate human receptor (e.g. an open space receptor in the buffer zone or an office worker receptor in the industrial area) in excess of 15 millirem. Since radiation dose is being examined for a 1,000 year time period, the draft EPA regulation conservatively assumes that institutional controls fail in the future and that a hypothetical resident moves onto the site. Due to the long lived nature of radionuclides at Rocky Flats, the working group is recommending the assessment of a hypothetical future resident. This recommendation was a conscious decision by the working group despite the guidance in the vision which provides for no future residential uses. The annual radiation dose received by this hypothetical future resident will not exceed 85 millirem. (Note: The annual radiation dose for this hypothetical individual in EPA's draft 40CFR196 recently changed from 75 mrem to 85 mrem.)

There are two action levels that need to be calculated for surface soils. Tier I action levels are numeric levels that, when exceeded, trigger an evaluation, remedial action and/or management action, given the presence of institutional controls. Tier II action levels are numeric levels that, when met, do not require remedial action and/or institutional controls. The final action levels were derived by examining both the hypothetical future resident action levels and the action levels based on the most appropriate land use and then choosing the most conservative action level. The radionuclide working group recommends adopting the Tier I and Tier II methodology outlined in the "Action Levels and Standards Framework for Radionuclides in Surface Water, Groundwater and Soils (ALF)". Proposed modifications to ALF and a discussion of put-back levels can be found in the document entitled, "Modifications to the Action Levels and Standards Framework". Table ES-1, "Tier I & II Soil Action Levels," outlines the Tier I and Tier II action levels being recommended by the radionuclide working group. The working group is recommending that the hypothetical future resident exposure scenario at the 85 mrem level be the Tier I action level for surficial soils in the buffer zone. The working group is also recommending that the office worker exposure scenario at the 15 mrem level be the Tier I action level for surficial soils in the industrial area. Further, the working group is recommending that the Tier II action level be the hypothetical future resident exposure scenario at the 15 millirem level.

Per the ALF, subsurface soil action levels must be protective of surface water standards through the transport of contaminants in ground water. The ALF requires that subsurface soil action levels be based on the leaching of contaminants to ground water, such that the ground water levels are protective of surface water standards. This concept was discussed by the radionuclide working group and not recommended for use at RFETS. Since the subsurface soils at RFETS are highly heterogeneous, it is not currently possible to accurately model radionuclide transport in these subsurface soils. Therefore, the radionuclide working group currently recommends a conservative approach by applying the Tier I and Tier II surface soil action levels to the subsurface soils. In addition, subsurface soil leaching of radionuclides to

ground water is currently being investigated at the RFETS. If an accurate subsurface soil leaching model can be developed for RFETS in the future, and is agreed upon by the RFCA parties, the current working group recommendations may need to be updated.

### **RESRAD INPUT PARAMETERS**

In the RESRAD computer code, there are approximately seventy different inputs that were discussed and agreed upon by the radionuclide working group for each exposure scenario. Site-specific values were chosen for these inputs whenever possible so that the action levels could be tailored to RFETS. If a site-specific value was not available, the RESRAD default input was used. The RESRAD code was used to evaluate the office worker exposure scenario, the open space exposure scenario and the hypothetical future resident exposure scenario over the 1,000 year modeling period.

### **RECOMMENDATIONS**

The working group recommends that the hypothetical future resident exposure scenario at the 85 mrem level be the Tier I action level for surficial soils in the buffer zone. The working group also recommends that the office worker exposure scenario at the 15 mrem level be the Tier I action level for surficial soils in the industrial area. Further, the working group is recommending that the Tier II action level for the entire site be the hypothetical future resident exposure scenario at the 15 millirem level. Soils with levels of radionuclides at or below the Tier II action level do not require remedial action and/or institutional controls. Although direct exposure to subsurface soils is not anticipated for the hypothetical future resident, open space or office worker exposure scenarios, the radionuclide working group currently recommends conservatively applying the Tier I and Tier II surface soil action levels to the subsurface soils. This subsurface soil recommendation may be updated in the future.

Table ES-1 outlines these Tier I and Tier II action levels

This working group acknowledges that in the future, new regulations, different guidance, improved calculation methods and models and better input parameters will likely become available. As this new information becomes available it will be considered in accordance with paragraph 5 of RFCA.

### APPLICATION

Action levels as calculated above are only applicable when a single radionuclide is found in the environment. This is not the case at RFETS. In the environment at RFETS, the uranium (U) isotopes of U-234, U-235 and U-238 are found together, and the americium (Am) and plutonium (Pu) isotopes of Am-241 and Pu-239/240 are found together. When multiple radionuclides are found in the environment, it must be ensured that the sum of the radiation doses from all radionuclides present does not exceed the action level basis (e.g., a hypothetical future resident assessed at the 15 mrem level).

The action levels for americium and plutonium together can also be calculated since the activity of Am-241 is about 18% of the Pu-239+Pu-240 (Pu-239/240) activity in the environment (Ibrahim, 1996). Given this activity ratio, the action level for Am-241 and Pu-239/240 can be computed so that the sum of their radiation doses equals either 15 or 85 millirem to the appropriate exposure scenario. Table ES-1 includes an example of these adjusted action levels for Am-241 and Pu-239/240 if they are the only radionuclides present in soil. Since the 18% ratio actually varies in the environment, site specific data will be used to make action level comparisons. If uranium is also present in the soil, then the contribution to the radiation dose from the uranium also needs to be assessed so that the Tier I and/or Tier II action level basis is not exceeded.

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## **SECTION 1**

### **INTRODUCTION**

During the Rocky Flats Cleanup Agreement (RFCA) negotiations, the Action Levels and Standards Framework for Surface Water, Ground Water and Soils (ALF) Working Group realized that setting soil action levels and cleanup standards for radionuclides was a complex process and could not be completed before public notice of the draft RFCA. Therefore a radionuclide working group was formed to undertake this task. This report discusses the formation of a radionuclide working group, the radionuclide working group's application of the 15/75 mrem methodology as outlined in the draft RFCA and the radionuclide working group's recommendations concerning radionuclide action levels in soils.

Section 2 of this report discusses the formation of the radionuclide working group along with the goals of the working group. The working group members represent the US Department of Energy (DOE), the US Environmental Protection Agency (EPA), the Colorado Department of Public Health and the Environment (CDPHE) and Kaiser-Hill (K-H), L L C.

Section 3 of this report is a regulatory analysis that describes the regulatory basis for deriving radionuclide action levels in soils. Regulations promulgated by the DOE, EPA and Nuclear Regulatory Commission (NRC) are examined.

Section 4 of this report contains the site conceptual model for surface and subsurface soil assessment. The site conceptual model is the basis for the exposure scenarios used to derive action levels for soils.

Section 5 of this report discusses how the soil action levels were developed. The use of the RESRAD computer model is discussed and the action levels for all applicable exposure scenarios are given.

Appendix A of this report discusses the development of the parameter inputs to the RESRAD.

computer code for the hypothetical future resident exposure scenario, the open space exposure scenario and the office worker exposure scenario RESRAD computer code outputs are also in this appendix

Appendix B of this report discusses the expected chemical form of plutonium in the environment The chemical form of radioactive material is significant for assessing radiation dose

Appendix C of this report is an exposure pathway analysis The exposure pathways applicable to the hypothetical future resident exposure scenario, the open space exposure scenario and the office worker exposure scenario are discussed and delineated

Appendix D of this report discusses the relative importance of different isotopes of plutonium with respect to human health The decay of plutonium, the ingrowth of daughters and plutonium toxicity are examined

## SECTION 2

### RADIONUCLIDE WORKING GROUP FORMATION AND GOALS

The radionuclide working group convened in early March 1996 and was composed of personnel from the DOE, the EPA, the CDPHE and the K-H Team. The Working Group agreed that its charter was to determine the derivation and application of the 15 mrem per year level as well as the derivation and potential application of the 75 mrem per year level as outlined in the Rocky Flats Cleanup Agreement. The Working Group recognized that the 15/75 requirement was based on EPA's preliminary proposed 40CFR196, Radiation Site Cleanup Regulations.

The goals of the Working Group were

- ☞ To determine and recommend radionuclide action levels for soil,
- ☞ To determine and recommend radionuclide put-back levels for soil, and
- ☞ To prepare a draft technical justification document which would explain the Working Group's recommendations

The Working Group believes its recommendations are based on a sound technical, scientific and regulatory foundation. The Working Group has consulted with the Citizens Advisory Board (CAB), the Cities of Broomfield, Westminster, Northglenn and Thornton, and the Rocky Flats Environmental Technology Site (RFETS) expert panel on radionuclide fate and transport concerning any recommendations. Proposed modifications to ALF and a discussion of put-back levels can be found in the document entitled, "Modifications to the Action Levels and Standards Framework."

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**SECTION 3**  
**REGULATORY ANALYSIS OF RADIONUCLIDES IN SOILS**

**3.1 Introduction**

In order to calculate action levels for radionuclides, a target radiation dose to an individual must be defined. This target radiation dose could be applicable to a current or future individual. After the target radiation dose is selected, the amount of radioactive material in the environment that corresponds to this target radiation dose can be calculated. This calculated value is the action level.

To select the target radiation dose, applicable regulations need to be reviewed so that regulatory requirements are met. Applicable regulations from the DOE, the EPA and the NRC were reviewed. The following radiation dose standards may apply to the assessment and remediation of radionuclides in the environment at the RFETS. These standards were evaluated so that the requirements of both current and proposed radiation protection standards could be assessed.

- \* DOE Order 5400.5, "Radiation Protection of the Public and the Environment "
- \* Proposed Title 10 of the Code of Federal Regulations, Part 834, "Radiation Protection of the Public and the Environment," revised August 25, 1995 (Proposed 10CFR834)
- \* Draft Title 40 of the Code of Federal Regulations, Part 196, "Radiation Site Cleanup Regulations," dated October 21, 1993 (Draft 40CFR196)
- \* Proposed Title 10 of the Code of Federal Regulations, Parts 20, 30, 40, 50, 51, 70 & 72, "Radiological Criteria for Decommissioning," dated August 22, 1994 (Proposed

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## 10CFR-NRC)

None of the above regulations is based on assessing and remediating radioactive materials based on risk assessment. EPA is promoting this departure from risk assessment with their draft 40CFR196. Since the DOE, EPA and NRC are promulgating regulations using radiation dose to assess and remediate radioactive material in the environment, risk assessment will not be the basis for calculating action levels.

The requirements of the National Emission Standards for Hazardous Air Pollutants (NESHAPS) are not being considered to develop action levels, however, DOE is obligated to comply with the requirements of NESHAPS as long as RFETS is a DOE site. The DOE currently has a NESHAPS program in place. If monitoring detects a significant increase in emissions of radionuclides to the ambient air that may be due to radionuclides in soils, a source evaluation and mitigating action may be required. The action levels should be consistent with the NESHAPS requirements, since even the worst areas of soil contamination do not currently cause ambient air to exceed the NESHAPS standards.

### 3.2 DOE Order 5400.5

DOE Order 5400.5 prescribes the use of a 100 millirem annual radiation dose limit as recommended by the International Commission on Radiological Protection (ICRP, 1977). This order includes a recommendation that a 30 mrem radiation dose limit be applied if the actual use of a site is being examined or if the likely future use of a site is being examined. The order states that acceptable levels of radionuclides in soil shall be derived based on an environmental pathway analysis with specific property data where available. The order further states that acceptable residual radionuclide concentrations will be derived using the RESRAD (Argonne, 1993) environmental transport and radiation dose computer code. An

As Low As Reasonably Achievable (ALARA) analysis must be a part of the RESRAD analysis. An ALARA analysis tries to reduce the radiation dose limit taking into account economic, social and technical factors.

The actual use or the likely future use exposure scenario represents the individual that could receive the largest radiation dose. For exposure scenarios considered to be less likely but plausible, the 100 millirem/year limit should not be exceeded. These exposure scenarios could include a resident, an industrial worker and/or a recreational user. Radiation dose is assessed for these exposure scenarios every year in a 1,000 year time period.

### **3.3 Proposed 10CFR834**

The provisions of DOE Order 5400.5 are currently being proposed as 10CFR834. Proposed 10CFR834 reiterates the 100 millirem per year radiation dose standard and also states that the starting point for an ALARA analysis would be 25 to 30 millirem per year. This regulation requires an environmental pathway analysis using approved models such as RESRAD to derive acceptable levels of radionuclides in the soil. With respect to exposure scenarios, 10CFR834 states that the actual and likely use scenarios and the worst plausible use scenario shall be evaluated. The requirement to evaluate the worst plausible use is only a secondary check to ensure that application of the likely use scenario does not overlook an extremely hazardous situation or a very susceptible subgroup. 10CFR834 also recommends that the dose assessment be performed for a 1,000 year time period.

### **3.4 Draft 40CFR196**

Draft 40CFR196 states that a remediation standard of 15 mrem/yr should be used at sites with radioactive material in all environmental media. This radiation dose limit would apply

to sites where the future land use is either unrestricted or restricted following remediation activities. If the land use at a site is restricted (e.g., restricting land use to open space use), the 15 mrem/year limit would apply to the restricted land use. If the land use is unrestricted, draft 40CFR196 also requires the assessment of the unrestricted release exposure scenario (i.e., residential exposure scenario). The radiation dose to be received by an unrestricted release exposure scenario will not exceed 75 mrem/yr (This has recently been updated to 85 mrem/yr) so that any individual will not receive more than the ICRP recommended dose limit of 100 millirem even if land use restrictions fail in the future. An ALARA analysis is not required.

EPA performed an extensive regulatory review before promulgating draft 40CFR196. The preamble to draft 40CFR196 compares the risks associated with remediation, transportation and disposal of contaminated soils against the risks of leaving contaminated soils in place at the 15/75 mrem per year dose limit. EPA concluded that the use of a 15/75 mrem dose limit is protective of the public. EPA recognized that the dose assessment process incorporates all pertinent facets of a CERCLA risk assessment process.

A 1,000 year time period also needs to be assessed to comply with the requirements in draft 40CFR196. This requirement came from the fact that many sites contain radionuclides with very long half-lives. The use of this assessment period will ensure that the creation of decay products and the long-term integrity of any land use restrictions are adequately considered.

### **3.5 Proposed 10CFR-NRC**

The proposed NRC decommissioning regulations are directly comparable to the EPA's draft 40CFR196 regulations. The NRC uses a 15 mrem/yr radiation dose limit for both unrestricted and restricted land uses at a site just like the EPA draft standard. If a site is

implementing land use restrictions, the NRC allows an individual in the future to receive a radiation dose of 100 millirem instead of 85 millirem. The NRC uses a 1,000 year assessment period and requires that an ALARA analysis be performed.

### **3.6 Rocky Flats Cleanup Agreement Regulatory Basis**

The Radionuclide Action Levels Working Group has decided to use the draft 40CFR196, "Radiation Site Cleanup Regulations," regulations to derive action levels at the RFETS. This decision was made by the working group for the following reasons:

- \* Remediation activities at the RFETS follow EPA and State of Colorado remediation requirements as outlined in the Rocky Flats Cleanup Agreement (RFCA). For radionuclide remediation, EPA's most current regulations need to be addressed.
- \* Draft 40CFR196 is based on an extensive review of available radiation protection information.
- \* Draft 40CFR196 is expected to be promulgated in the near future.
- \* Draft 40CFR196 is not inconsistent with the requirements of DOE Order 5400.5, proposed 10CFR834 and the proposed NRC decommissioning regulations.
- \* NRC regulations do not apply to DOE facilities.

## **SECTION 4**

### **SITE CONCEPTUAL MODEL**

#### **4.1 Introduction**

The Site Conceptual Model (SCM) outlines the land uses that are expected to be present at the RFETS so that action levels can be calculated for these future land uses. The type of land use is very important since the amount of time an individual may contact radioactive material in the environment is directly related to the selected land use. This contact time is then transformed into an amount of radioactive material inhaled or ingested by the individual. Action levels are derived from the radiation dose associated with radioactive material inhaled and ingested, and from external gamma exposure.

#### **4.2 Land Uses at RFETS**

Future activities at RFETS include environmental restoration, decontamination and decommissioning, economic development and waste management. The Rocky Flats Local Impact Initiative is currently working with DOE and local development agencies to encourage business development at RFETS. The Rocky Flats Future Site Uses Working Group has also developed recommendations regarding future use of the RFETS property. Residential development at RFETS has not been recommended by this group or by other planning groups. Commercial and industrial uses of developed portions of the site are considered beneficial. Even though commercial development in undeveloped portions of the property has not been ruled out, preservation of this area as open space is consistent with DOE policy, the Rocky Flats Future Site Working Group recommendations and the Jefferson County Planning Department's recommendations. The Jefferson County Board of Commissioners has also adopted a resolution stating its support of maintaining, in perpetuity, the undeveloped buffer zone as open space (DOE, 1995). Open space use assumes no

development in these areas

The land uses for RFETS are prescribed by the Rocky Flats Cleanup Agreement (RFCA) in the preamble to that document (RFCA, 1996). The preamble states that cleanup decisions and activities are to be based on open space use and limited industrial use at RFETS. These land uses are consistent with the direction of local government as outlined above. In the near-term condition, the inner and outer buffer zones will be managed and remediated to accommodate open space uses. At the beginning of the intermediate term condition, open space use in these areas will still be applicable. Industrial uses are applicable in the industrial area of the plant in the near and intermediate term conditions. The RFCA prescribes that specific future land uses and post-cleanup designations will be developed in consultation with local governments.

#### **4.3 Surface Soil Assessment**

To be consistent with the RFCA (RFCA, 1996), the basis for radionuclide action levels in surface soils is an open space exposure scenario in the buffer zone and an office worker exposure scenario in the industrial area of the plant. Consistent with 40CFR196, the working group agreed that the hypothetical future residential exposure scenario would also be evaluated. Although conservative, the assessment of a residential exposure scenario is inconsistent with current land use recommendations. Surface soils are defined as the top 15 cm of soil. —

The open space exposure scenario assumes that an individual visits the buffer zone a limited portion of the year for recreational activities. This individual could hike on trails or wade in the creeks. This individual is assumed to be exposed to radioactive material in soils by directly ingesting the soils, by inhaling resuspended soils and by external gamma exposure.

from the soils Appendix C, "Analysis of Exposure Pathways for use in Deriving Action Levels," contains a detailed discussion on the selection of these three exposure pathways For an account of the amount of time the open space user spends at RFETS, see Appendix A, "Parameter Justification and RESRAD Output " The action level for the open space exposure scenario is the amount of a specific radioactive material in surface soil that would impart an annual radiation dose of 15 millirem to the open space user during the 1,000 year assessment period

The office worker exposure scenario assumes that an individual works mainly indoors in a building complex surrounded by extensive paved areas or well maintained landscaping This individual is assumed to breath outside air and ingest soil from outside the building This individual is assumed to be exposed to radioactive material in soils by directly ingesting the soils, by inhaling resuspended soils and by external gamma exposure from the soils Appendix C, "Analysis of Exposure Pathways for use in Deriving Action Levels," contains a detailed discussion on the selection of these three exposure pathways For an account of the amount of time the office worker spends at RFETS, see Appendix A, "Parameter Justification and RESRAD Output " The action level for the office worker exposure scenario is the amount of a specific radioactive material in surface soil that would impart an annual radiation dose of 15 millirem to the office worker during the 1,000 year assessment period

The hypothetical future residential exposure scenario assumes that an individual resides at RFETS This individual lives at RFETS all year and eats homegrown produce This individual is assumed to breath outside air and ingest soil from outside the residence This individual is assumed to be exposed to radioactive material in soils by directly ingesting the soils, by inhaling resuspended soils, by external gamma exposure from contaminated soil and by ingesting produce grown in contaminated soil Appendix C, "Analysis of Exposure Pathways for use in Deriving Action Levels," contains a detailed discussion on the selection of these four exposure pathways For an account of the amount of time the resident spends at

RFETS, see Appendix A, "Parameter Justification and RESRAD Output " The action level for the residential exposure scenario is the amount of a specific radioactive material in surface soil that would impart an annual radiation dose of 15 millirem or 85 millirem to the hypothetical resident during the 1,000 year assessment period

In order to carry out the original weapon-building mission, personnel at RFETS handled plutonium (Pu), americium (Am) and uranium (U) in a number of different operations Rocky Flats plutonium was composed of Pu-238, Pu-239, Pu-240, Pu-241, Pu-242 and Am-241 (DOE, 1980), and the isotopes of uranium handled at RFETS are U-234, U-235 and U-238 Action levels in soils have been derived for Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Am-241, U-234, U-235 and U-238 in the environment

To calculate the radiation dose to an individual, appropriate Dose Conversion Factors (DCF) must be chosen These DCFs convert the radioactive material present in an exposure route to a radiation dose The three exposure routes are the ingestion, inhalation and external gamma exposure from radioactive material in soil DCFs are therefore available for the ingestion, inhalation and external exposure routes The DCF for each exposure route differs with the chemical form of the radionuclide The chemical form for americium, uranium and all daughter products were conservatively chosen so that the DCF would be maximized for each exposure route. The DCFs for plutonium were chosen based on the oxide form For a detailed discussion of the chemical form of plutonium in the environment, see Appendix B, "Analysis of the Chemical Form of Plutonium in the Environment "

#### **4.4 Subsurface Soil Assessment**

Subsurface soils are defined from 15 cm below the ground surface to the top of the ground water table There are no exposure pathways present for the open space, office worker or

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hypothetical resident exposure scenarios to subsurface soils. Therefore, these exposure scenarios are not appropriate for subsurface soils. For this reason, the RFCA (RFCA, 1996) states that action levels derived for subsurface soils will be protective of surface water standards via ground water transport of radionuclides leached from subsurface soils. The surface water standard for radionuclides is the Maximum Contaminant Level (MCL) as defined by the RFCA.

The SCM for subsurface soils is represented by radionuclides first leaching from subsurface soils to ground water. The radionuclides in ground water are then transported to surface water where the radionuclide concentration cannot exceed the MCL. The subsurface soil action level is the smallest amount of a specific radioactive material in subsurface soil that would impart an MCL in surface water over the 1,000 year assessment period.

This subsurface soil SCM was examined closely by the radionuclide working group. The geohydrology of the RFETS was examined along with the subsurface soil transport properties of plutonium, americium, uranium and their daughter products. Also, the relationship between the subsurface soil SCM and the surface soil SCM was examined. The radionuclide working group came to the conclusion that a subsurface soil action level for radionuclides could not be developed at this time with the subsurface soil SCM defined by the RFCA. This conclusion was based on the variable characteristics of the SCM. This variability is attributable to 1) a water infiltration rate into the soil which varies both areally across the site and within the subsurface soils, 2) radionuclide-specific distribution coefficients that vary spatially within the subsurface soil, 3) a variable distance from a source of radioactive material in the subsurface soil to surface water and 4) a variable soil unsaturated/saturated zone thickness across RFETS. For these reasons, the radionuclide working group has decided to conservatively apply surface soil action levels to subsurface soils.

Currently there are efforts proceeding that may reduce the variability in the subsurface soil SCM. In the future, this variability may be reduced sufficiently to allow the application of the prescribed subsurface soil SCM. If this occurs, the current recommendation of the radionuclide working group may be modified.

## **SECTION 5**

### **ACTION LEVEL DEVELOPMENT**

#### **5.1 Introduction**

All of the ingredients for developing action levels for radionuclides in surface soils have been delineated in the preceding sections. A radiation dose limit has been established, the applicable exposure scenarios have been defined and the type of soil to be assessed has been defined. All of these facets allow the calculation of a surface soil action level for the open space exposure scenario, the office worker exposure scenario and the hypothetical future residential exposure scenario. Due to the complex nature of action level development, a computer model must be utilized to derive the action levels. The RESRAD computer model was selected for use since it fulfills all modeling requirements. Action levels were developed for the given exposure scenarios in surface soils. These action levels will be used as Tier I and Tier II action levels in the Action Levels and Standards Framework for Surface Water, Groundwater and Soils (RFCA, 1996).

#### **5.2 Computer Code Requirements**

There are a number of different processes that need to be assessed to derive action levels. Due to the complexity of each of these processes, it would be beneficial to have a computer code that would assess each of the following processes. For efficiency and compatibility reasons, the ideal computer code would incorporate all of the following processes. It is also important that the computer code(s) be validated and verified.

The first process that has to be modeled is the transport of radioactive material in surface soil to an individual. This transport can include soil transport in air, surface water, ground water and/or unsaturated zone pore water. For assessing surface soil, the most important

environmental transport process for deriving action levels is the air transport process. This is important for the inhalation exposure pathway. All other environmental transport processes serve to decrease the amount of radioactive material present in surface soil. This decrease in radioactive material over time increases the action level over time. All environmental transport processes modeled must be able to assess the movement of radioactive material and their daughter products over the 1,000 year assessment period.

The second process that needs to be examined is the exposure of a receptor to the radioactive material in the soil. There are four exposure pathways that need to be assessed by the chosen computer code. These pathways include incidental ingestion of soil, inhalation of resuspended soil, external gamma exposure from radionuclides in the soil and ingestion of homegrown produce.

The next process to be concerned with is radiation dosimetry. Once the radioactive material enters the body, a radiation dose must be calculated so that an action level can be derived. There are three modes through which radioactive material can impart radiation dose to an individual. These are through the ingestion of radioactive material, the inhalation of radioactive material and external gamma exposure from radioactive material in soil. All three of these radiation dose modes need to be assessed for each radionuclide. Since a 1,000 year assessment period is required, the radiation dose from daughter products must also be assessed.

### **5.3 Computer Code Selection**

The RESRAD computer code (Argonne, 1993) was selected for use in deriving surface soil action levels because it meets all modeling requirements. RESRAD was developed at Argonne National Laboratory for the US Department of Energy (DOE) so that radiation dose

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to an individual as well as action levels could be derived for radioactive material in soils. RESRAD can model all four of the above processes in an integrated manner and can assess daughter products over the 1,000 year modeling period. RESRAD has also been validated and verified (Argonne, 1994).

Surface soils can be physically modeled by the RESRAD code. Soils are broken down into layers within the code, and the top layer, at the ground surface, can be a cover or a contaminated zone. For deriving surface soil action levels, the contaminated zone is considered to be the surface soils with no cover. Underneath the contaminated zone, RESRAD has the capacity to model five separate uncontaminated/unsaturated layers before reaching ground water. This configuration meets the requirements for deriving action levels at the RFETS.

RESRAD can model the required environmental transport processes. It contains an air transport algorithm that looks at resuspension of radioactive material in soils and transport to an individual. The assessment of the air transport pathway is essential to calculating surface soil action levels. Unsaturated zone transport and ground water transport processes are also assessed within the RESRAD code. These two algorithms will allow leaching of radioactive material out of the surface soils for the 1,000 year assessment period. These unsaturated zone transport and ground water transport algorithms could be used in the future to model the leaching of contaminants from subsurface soils at the RFETS. With respect to environmental transport requirements, RESRAD meets the requirements for deriving action levels at RFETS.

The RESRAD code can model the four exposure pathways: incidental ingestion of soil, inhalation of resuspended soil, external gamma exposure from radionuclides in the soil and ingestion of homegrown produce. RESRAD can assess nine exposure pathways in total.

These exposure pathways are external gamma exposure, soil inhalation, plant ingestion, meat ingestion, milk ingestion, aquatic food ingestion, drinking water ingestion, soil ingestion and radon exposure. This shows the flexibility of the RESRAD code in assessing many different situations. Exposure pathways can be turned on and off in RESRAD depending on the specific situation. Concerning exposure pathways, this meets the requirements for deriving action levels at the RFETS.

The RESRAD code also has an extensive library of radionuclides in their radiation dosimetry module. This allows the calculation of radiation dose and action levels on the radionuclides of interest and on their daughter products over the 1,000 year modeling period. The radionuclide database includes inhalation, ingestion and external exposure Dose Conversion Factors (DCF). These DCFs are also available within RESRAD for the different chemical forms of radionuclides. Concerning the use of DCFs, this meets the requirements for deriving action levels at the RFETS.

#### **5.4 RESRAD Parameter Input Development**

There were four separate RESRAD computer runs that needed to be performed to obtain all required action levels. These included the following:

- \* An Open Space Exposure Scenario Assessed at the 15 Millirem Level
- \* An Office Worker Exposure Scenario Assessed at the 15 Millirem Level
- \* A Hypothetical Future Resident Assessed at the 15 Millirem Level
- \* A Hypothetical Future Resident Assessed at the 85 Millirem Level

There were 53 separate input parameters to the RESRAD code for the open space and office worker exposure scenarios. The hypothetical future resident had 83 separate input

parameters. The parameters for all of these exposure scenarios were chosen to be as site specific as possible to satisfy the requirements of the site conceptual model. When a site specific parameter was not available, the RESRAD default parameter was used. For a discussion of all parameter inputs with their selected values, see Appendix A, "Parameter Justification and RESRAD Output."

## **5.5 RESRAD Modeling Results**

Table 5-1, "Single Radionuclide Soil Action Levels," outlines the Tier I and Tier II action levels developed using RESRAD. The action levels in this table represent the radionuclide-specific activity in the soil that would impart a maximum radiation dose of either 15 millirem or 85 millirem to the given exposure scenario over the 1,000 year modeling period.

## **5.6 Use of RESRAD Modeling Results**

The action levels outlined above need to be applied in the field. To do this, a number of simplifying assumptions can be made while still assuring the protectiveness of the action levels. This simplification allows implementation of these action levels in an efficient manner.

The first simplification is that the number of radionuclides needing assessment at RFETS can be reduced. All uranium (U) radionuclides present at RFETS (e.g., U-234, U-235 and U-238) in the environment will be assessed with respect to their action levels. Appendix D, "Analysis of Assessment Needs for Rocky Flats Plutonium," outlines the reasons why the only constituents from Rocky Flats plutonium that need to be assessed in the environment are Pu-239, Pu-240 and Am-241. All isotopes of Rocky Flats plutonium were initially assessed

for completeness since plutonium in the nuclear fabrication process was composed of Pu-238, Pu-239, Pu-240, Pu-241 and Pu-242 (DOE, 1980) Am-241 is also contained in this mix of plutonium due to its ingrowth from Pu-241 (DOE, 1980) The plutonium found in the environment though will have different activities of plutonium and americium than what is found in the fabrication process because of radionuclide decay and ingrowth over time In examining this decay and ingrowth with regard to radionuclide toxicity, it is shown in Appendix D that it is necessary to only assess Pu-239, Pu-240 and Am-241 in the environment

The number of exposure scenarios that need to be examined can also be reduced The more conservative of the Tier I action level for the open space exposure scenario and the Tier I action level for the hypothetical future resident will be applied in the buffer zone at RFETS Also, the more conservative of the Tier I action level for the office worker exposure scenario and the Tier I action level for the hypothetical future resident will be applied in the industrial area at RFETS These comparisons were made and the result is that the Tier I action level in the buffer zone will be based on the hypothetical future resident exposure scenario and that the Tier I action level in the industrial area will be based on the office worker exposure scenario Table 5-2, "Tier I & II Soil Action Levels," outlines the soil action levels after the above simplifications are made

To assure that the soil action levels will be protective of human health when multiple radionuclides are present, the sum of the radiation doses from all radionuclides in soil must not exceed the Tier I or Tier II dose limit of 15 millirem or 85 millirem A "Sum of Ratios" method will be used when more than one radionuclide is present in soils Table 5-3, "Sum of Ratios Example," outlines this method First, a ratio is formed for each radionuclide by dividing the activity of the radionuclide found in soils by the appropriate soil action level This ratio actually represents the fraction of the radiation dose from the action level In Table 5-3, the action level chosen for comparison is the Tier II action level for RFETS which is the

hypothetical future resident assessed at the 15 millirem level. In this example, the radiation dose from U-235 is 1% of 15 millirem or 0.15 millirem at a soil activity of 0.3 pCi/gram. Therefore, when the ratio from each radionuclide is summed, this ratio sum is the fraction of the radiation dose limit for the action level. In Table 5-3, the sum of the ratios is 0.22 or 22% of 15 millirem. In this example, the Tier II action level is not exceeded since the sum of ratios is less than or equal to 1.0. If the sum of ratios exceeded 1.0, the action level would be exceeded.

The action levels for americium and plutonium together can also be calculated since the activity of Am-241 is about 18% of the Pu-239+Pu-240 (Pu-239/240) activity in the environment (Ibrahim, 1996). Given this activity ratio, the action level for Am-241 and Pu-239/240 can be computed so that the sum of their radiation doses equals either 15 or 85 millirem to the appropriate exposure scenario. Table 5-2 includes an example of these adjusted action levels for Am-241 and Pu-239/240 if they are the only radionuclides present in soil. Since the 18% ratio actually varies in the environment, site specific data will be used to make action level comparisons. If uranium is also present in the soil, then the contribution to the radiation dose from the uranium also needs to be assessed so that the Tier I and/or Tier II action level basis is not exceeded.

Chemical action levels are risk-based, and chemical risk is considered additive when multiple chemicals are present. Radionuclide action levels are dose-based, and radiation dose is considered additive when multiple radionuclides are present. Chemicals and radionuclides will be assessed independently on a project-specific basis using methodology that is protective of human health and the environment. The cumulative effects of chemicals and radionuclides will be assessed on a project-specific basis if the chemical risk and the radionuclide dose are near their respective Tier I action levels.

## 5.7 Action Level Uncertainties

The calculated values recommended as action levels are based on several assumptions which have associated limitations. These include

- 1 The regulatory basis for developing these action levels is EPA's draft rule, 40CFR196, which is not yet final and may be changed before it is promulgated
- 2 Any environmental computer model, including the RESRAD model, has inherent limitations with regard to precise simulation of the actual environment. Some of these limitations involve which input parameters are chosen to represent the complex natural setting which may vary across a large site. Environmental transfer factors and dose conversion factors used in the model may not always reflect site-specific conditions
- 3 There are inherent uncertainties in estimating either dose or risk from ionizing radiation
- 4 Institutional controls will eliminate the ground water ingestion pathway by establishing specific land uses and controls on ground water use. A basic assumption of RFCA is that ground water from contaminated areas of the site is captured, controlled and measured within the surface water system before leaving the site. An additional assumption is that the small amount of shallow ground water is not a sustainable, viable source of residential drinking water
- 5 Attachment 5 of RFCA requires subsurface soil action levels to be protective of surface water standards via ground water, and surface soil action levels to be

protective of surface water standards via runoff Existing data supports the proposition that radionuclides in soil are stable and relatively immobile This is the basis for determining not to include these transport pathways in the modeling done to develop the proposed action levels It is also assumed that actions required by the proposed action levels for radionuclides in soil (removals and/or stabilization) will provide sufficient protection for surface water Those actions will control the worst areas of radiological contamination in soils, and so far, even these areas have not impacted surface water above the 0.15 pCi/L level at the point of compliance

- 6 The proposal to set subsurface soil action levels equal to surface soil action levels assumes there will be no uncontrolled human exposure to subsurface soils and presumes that surface soil action levels will be protective of surface water via ground water It is also assumed that the proposed surface soil action levels are lower than values that any subsurface soil modeling would produce

This working group acknowledges that in the future, new regulations, different guidance, improved calculation methods and models and better input parameters will likely become available As this new information becomes available it will be considered in accordance with paragraph 5 of RFCA

**TABLE 5-1**  
**SINGLE RADIONUCLIDE SOIL ACTION LEVELS**

<b>Radionuclide</b>	<b><u>TIER I</u> <u>ACTION</u> <u>LEVEL</u></b>  <b>Open Space Exposure Scenario, Surficial Soils Exposure, 15 Millirem Dose Limit (pCi/gram)</b>	<b><u>TIER I</u> <u>ACTION</u> <u>LEVEL</u></b>  <b>Office Worker Exposure Scenario, Surficial Soils Exposure, 15 Millirem Dose Limit (pCi/gram)</b>	<b><u>TIER I</u> <u>ACTION</u> <u>LEVEL</u></b>  <b>Hypothetical Residential Exposure Scenario, Surficial Soils Exposure, 85 Millirem Dose Limit (pCi/gram)</b>	<b><u>TIER II</u> <u>ACTION</u> <u>LEVEL</u></b>  <b>Hypothetical Residential Exposure Scenario, Surficial Soils Exposure, 15 Millirem Dose Limit (pCi/gram)</b>
Americium-241	1283	209	215	38
Plutonium-238	10580	1164	1529	270
Plutonium-239	9906	1088	1429	252
Plutonium-240	9919	1089	1432	253
Plutonium-241	48020	7801	19830	3499
Plutonium-242	10430	1145	1506	266
Uranium-234	11500	1627	1738	307
Uranium-235	1314	113	135	24
Uranium-238	5079	506	586	103

\* The action levels in this table apply to single radionuclides only which does not exist at RFETS See text for application of these action levels

## **SECTION 6**

### **REFERENCES**

#### **References**

Argonne, 1993 - Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0, Environmental Assessment and Information Sciences Division, Argonne National Laboratory, ANL/EAD/LD-2, September 1993

DOE, 1980 - Final Environmental Impact Statement, Rocky Flats Plant Site, Golden, CO, US Department of Energy, DOE/EIS-0064, April 1980

DOE, 1995 - Phase II RFI/RI Report, 903 Pad, Mound and East Trenches Area, Operable Unit Number 2, Draft Final, US Department of Energy, May 1995

Ibrahim, 1996 - Comparative Distribution of Am-241 and Pu-239/240 in Soils Around the Rocky Flats Environmental Technology Site, Health Physics, Vol 70, No 4, April 1996

ICRP, 1977 - International Commission on Radiological Protection (ICRP), Recommendations of the ICRP, ICRP Publication 26, 1977

RFCA, 1996 - Rocky Flats Cleanup Agreement, Joint Agreement between the US Department of Energy, the US Environmental Protection Agency, the Colorado Department of Public Health and Environment and the State of Colorado, dated July 19, 1996

## 1.0 INTRODUCTION

DOE developed risk-based PPRGs in 1995 to establish initial site-wide cleanup targets for contaminants for each environmental medium. The PPRGs are currently used in RFCA Attachment 5, as action levels for the following mediums:

- Groundwater Action Levels PPRGs based on residential groundwater ingestion scenario are used where no Maximum Contaminant Level (MCL) is available from EPA,
- Surface Soil Action Levels For non-radionuclides, PPRGs are used as action levels for the appropriate land use, e.g., industrial use or open space use, and
- Subsurface Soil Action Levels For non-radionuclide inorganics, PPRGs are used as action levels for the appropriate land use, e.g., industrial use or open space use.

PPRGs are reviewed and updated, as necessary, on an annual basis.

## 2.0 EXPOSURE PATHWAYS

In order to standardize the risk-based PPRGs across RFETS, programmatic exposure pathways and receptors were established. The following tables identify the receptors and exposure pathways selected for each environmental medium:

- Table 1 Residential Groundwater Exposure Scenario
- Table 2 Office Worker Soil Exposure Scenario
- Table 3 Open Space Surface Water Exposure Scenario
- Table 4 Open Space Surface Soil Exposure Scenario

Standard assumptions given in Risk Assessment Guidance for Superfund (RAGS), Part B (USEPA, 1991) were used in developing risk-based PPRG pathways where available. For situations not addressed by RAGS, Part B, standard assumptions given in RAGS, Part A (USEPA, 1989) were used. In addition, site-specific information was used where appropriate to supplement assumptions given in EPA guidance. Best professional judgement was applied when default values differed from site-specific information.

In addition to EPA and site-specific information, CDPHE guidance (*Interim Final Policy and Guidance on Risk Assessments for Corrective Action at RCRA Facilities*) was consulted for exposure pathways and parameters. While this guidance has not been finalized, it was reviewed and CDPHE was consulted on its use during development of the risk-based PPRG pathways.

### 3.0 METHODOLOGY, EQUATIONS, AND ASSUMPTIONS

Risk-based PPRGs were developed for all Target Analyte List metals, Target Compound List organics and 13 radionuclides for the residential groundwater exposure scenario, the office worker surface soil exposure scenario, the open space surface water exposure scenario, and the open space surface soil exposure scenario. Separate risk-based equations were developed to account for the carcinogenic, noncarcinogenic, and/or radiological effects of the contaminant. Risk-based PPRGs for carcinogens (including radionuclides) were calculated by setting the carcinogenic target risk level at  $10^{-6}$ . A target risk level of  $10^{-6}$  means that an individual has a one-in-one million probability of developing cancer over a lifetime as a result of exposure to a specific contaminant. This risk is in addition to the probability of an individual developing cancer from some other factors such as those associated with heredity or lifestyle. Similarly, risk-based PPRGs for toxicants (noncarcinogens) were calculated by setting the hazard quotient equal to 1 for each contaminant. A hazard quotient is the ratio of a single substance exposure level of a chemical contaminant over a specified period to the reference dose for the chemical. The reference dose represents an estimate of an exposure level for the human population, including sensitive subpopulations that is likely to be without appreciable deleterious effects during a lifetime. For some of the contaminants, both a carcinogenic and noncarcinogenic toxicity information was available. For these contaminants, both a carcinogenic and noncarcinogenic risk-based concentration was calculated and the more restrictive value was selected as the risk-based PPRG. The risk-based equations for radiological effects were used to calculate the risk-based PPRGs for the 13 radionuclides.

The risk-based PPRG exposure scenarios and equations provided in Table 1 through 4 include all of the exposure pathways (e.g., direct ingestion of soils) identified for the exposure scenario; separate risk-based PPRGs were not calculated for each exposure pathway.

### 4.0 CHEMICAL TOXICITY INFORMATION

The chemical-specific toxicity values used for the calculation of the risk-based PPRGs are presented in Table 5. The toxicity information used to calculate the risk-based PPRGs included in the slope factor and unit risk for evaluating carcinogenic effects, the reference dose (RfD), and the reference concentration (RfC) for evaluating noncarcinogenic effects. Toxicity values were obtained from the latest information in EPA's Integrated Risk Information System (IRIS) files and the 1997 EPA Health Effects Assessment Summary Tables. Values for polycyclic aromatic hydrocarbons were calculated using EPA's Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons.

### 5.0 RFETS PPRGs

Table 6 is a summary of the PPRGs for each exposure scenario.

Table 1 Residential Exposure Scenario RFETS PPRGs

The Residential Groundwater Exposure Scenario consists of the following pathway ingestion of groundwater (which includes radiation exposure while ingesting groundwater) for an adult resident living at the site for 30 years. This scenario includes only pathways that were evaluated in the Rocky Flats Cleanup Agreement (RFCA) to derive action levels.

Exposure Parameter	Variable	Unit	Value	Source
<b>General Assumptions</b>				
Target hazard index	THI	--	1	EPA, 1991a
Target excess lifetime cancer risk	TR	--	1E-06	EPA, 1991a
Adult body weight	BW	kg	70	EPA, 1991b
<b>Residential Exposure Scenario Assumptions</b>				
Averaging time - noncarcinogenic	AT_NC	yr	30	EPA, 1991b
Averaging time - carcinogenic	AT_C	yr	70	EPA, 1991b
Exposure frequency	EF	day/yr	350	EPA, 1991b
Exposure duration	ED	yr	30	EPA, 1991b
Daily water ingestion rate	IRw	L/day	2	EPA, 1991b
<b>Toxicity Values</b>				
Oral reference dose	RfDo	mg/kg-day	chemical-specific	--
Oral slope factor	SFo	(mg/kg-day) <sup>-1</sup>	chemical-specific	--
Ingestion slope factor - radiological effects	SForad	risk/pCi	chemical-specific	--
<b>Risk-Based PPRG</b>				
<b>Residential Groundwater Exposure Scenario-Noncarcinogenic Effects</b>				
PPRG (mg/L) = (THI x BW x AT_NC x 365d/yr)/(EF x ED x IRw x 1/RfDo)				
<b>Residential Groundwater Exposure Scenario-Carcinogenic Effects</b>				
PPRG (mg/L) = (TR x BW x AT_C x 365d/yr)/(EF x ED x IRw x SFo)				
<b>Residential Groundwater Exposure Scenario-Radiological Effects</b>				
PPRG (pCi/L) = TR/(EF x ED x IRw x SForad)				

**Notes**

-- Not applicable

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Table 1 Residential Exposure Scenario RFETS PPRGs

**Sources**

EPA, 1991a = U S Environmental Protection Agency 1991 Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals Interim. Office of Emergency and Remedial Response, Washington, D C Publication 9285 7-01B December  
EPA, 1991b = U S Environmental Protection Agency 1991 Human Health Evaluation Manual, Supplemental Guidance Standard Default Exposure Factors Office of Solid Waste and Emergency Response, Washington, D C OSWER Directive 9285 6-03 March 25

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Table 2 Office Worker Exposure Scenario RFETS PPRGs

The Office Worker Surface Soil Exposure Scenario consists of the following pathways: incidental ingestion of surface soil and indoor inhalation of surface soil particulates for an adult office worker at the site for 25 years. This scenario includes only pathways that were evaluated in the Rocky Flats Cleanup Agreement (RFCA) to derive action levels.

Exposure Parameter	Variable	Unit	Value	Source
<b>General Assumptions</b>				
Target hazard index	THI	--	1	EPA, 1991a
Target excess lifetime cancer risk	TR	--	1E-06	EPA, 1991a
Adult body weight	BW	kg	70	EPA, 1991b
<b>Office Worker Exposure Scenario Assumptions</b>				
Averaging time - noncarcinogenic	AT_NC	yr	25	EPA, 1991b
Averaging time - carcinogenic	AT_C	yr	70	EPA, 1991b
Exposure frequency	EF	day/yr	250	EPA, 1991b
Exposure duration	ED	yr	25	EPA, 1991b
Daily indoor inhalation rate	IRa	m <sup>3</sup> /day	8.8	ICRP 66, 1993
Particulate Emission Factor	PEF	m <sup>3</sup> /kg	1.32E+09	EPA, 1996
Soil ingestion rate	IRs	mg/day	50	EPA, 1991b
Gamma shielding factor	S <sub>g</sub>	--	0.2	EPA, 1991a
Gamma exposure factor (annual) = (EF / 365 day/yr) [a]	Te_A	--	6.85E-01	EPA, 1991a
Gamma exposure factor (daily) = (8 hr/day / 24 hr/day)	Te_D	--	3.33E-01	EPA, 1991a
<b>Toxicity Values</b>				
Oral reference dose	RfDo	mg/kg-day	chemical-specific	--
Oral slope factor	SFo	(mg/kg-day) <sup>-1</sup>	chemical-specific	--
Ingestion slope factor - radiological effects	SForad	risk/pCi	chemical-specific	--
Inhalation reference dose	RfDi	mg/kg-day	chemical-specific	--
Inhalation slope factor	SFi	(mg/kg-day) <sup>-1</sup>	chemical-specific	--
Inhalation slope factor - radiological effects	SFirad	risk/pCi	chemical-specific	--
External exposure slope factor	SFe	(risk/yr per pCi/g)	chemical-specific	--
<b>Risk-Based PPRG</b>				

**Office Worker Surface Soil Exposure Scenario-Noncarcinogenic Effects**  
 PPRG (mg/kg) = (THI x BW x AT\_NC x 365 day/yr) / (EF x ED x ((1/PEF x IRa x 1/RfDi) + (1E-06 kg/mg x IRs x 1/RfDo)))

Table 2 Office Worker Exposure Scenario RFETS PPRGs

**Office Worker Surface Soil Exposure Scenario-Carcinogenic Effects**

PPRG (mg/kg) =  $(TR \times BW \times AT\_C \times 365 \text{ d/yr}) / (EF \times ED \times ((1/PEF \times IRa \times SFi) + (1E-06 \text{ kg/mg} \times IRs \times SFo)))$

**Office Worker Surface Soil Exposure Scenario-Radiological Effects**

PPRG (pCi/g) =  $TR / [ED \times ((EF \times 1/PEF \times 10^3 \text{ g/kg} \times IRa \times SFi_{RAD}) + (EF \times 1E-03 \text{ g/mg} \times IRs \times SFo_{RAD}) + (SFe \times (1-Se) \times (Te\_A \times Te\_D)))]$

**Notes**

-- Not applicable

[a] Extrapolated to calculate annual exposure

**Sources:**

EPA, 1991a = U S Environmental Protection Agency 1991 Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals Internm Office of Emergency and Remedial Response, Washington, D C Publication 9285 7-01B December  
EPA, 1991b = U S Environmental Protection Agency 1991 Human Health Evaluation Manual, Supplemental Guidance Standard Default Exposure Factors Office of Solid Waste and Emergency Response, Washington, D C OSWER Directive 9285 6-03 March 25  
EPA, 1996 = U S Environmental Protection Agency 1996 Soil Screening Guidance Technical Background Document Office of Emergency and Remedial Response, Washington, D C EPA/540/R-95/128 May  
ICRP 66, 1993 = International Commission on Radiological Protection (ICRP) 1993 Human Respiratory Tract Model for Radiological Protection ICRP Publication 66 September

Table 3 Open Space Surface Water Exposure Scenario RFETS PPRGs

The Open Space Surface Water Exposure Scenario consists of the following pathway incidental ingestion of surface water for an open space visitor who recreates at the site for 30 years  
The open space receptor visits the site 100 times per year This scenario includes only pathways that were evaluated in the Rocky Flats Cleanup Agreement (RFCA) to derive action levels

Exposure Parameter	Variable	Unit	Value	Source
<b>General Assumptions</b>				
Target hazard index	THI	--	1	EPA, 1991a
Target excess lifetime cancer risk	TR	--	1E-06	EPA, 1991a
Adult body weight	BW	kg	70	EPA, 1991b
<b>Open Space Exposure Scenario Assumptions</b>				
Averaging time - noncarcinogenic	AT_NC	yr	30	EPA, 1991b
Averaging time - carcinogenic	AT_C	yr	70	EPA, 1991b
Contact rate	CR	L/hr	0.05	(1)
Exposure time	ET	hr/day	1	(2)
Exposure frequency	EF	day/yr	100	JeffCo, 1996
Exposure duration	ED	yr	30	EPA, 1991b
<b>Toxicity Values</b>				
Oral reference dose	RfDo	mg/kg-day	chemical-specific	--
Oral slope factor	SFo	(mg/kg-day) <sup>-1</sup>	chemical-specific	--
Ingestion slope factor - radiological effects	SForad	risk/pCi	chemical-specific	--

**Risk-Based PPRG**

**Open Space Surface Water Exposure Scenario-Noncarcinogenic**  
 $PPRG(mg/L) = (THI \times BW \times AT\_NC \times 365 \text{ d/yr}) / (CR \times ET \times EF \times ED \times 1/RfDo)$

**Open Space Surface Water Exposure Scenario-Carcinogenic**  
 $PPRG(mg/L) = (TR \times BW \times AT\_C \times 365 \text{ d/yr}) / (CR \times ET \times EF \times ED \times SFo)$

**Open Space Surface Water Exposure Scenario-Radiological Effects**  
 $PPRG(pCi/L) = (TR) / (CR \times ET \times EF \times ED \times SForad)$

Table 3 Open Space Surface Water Exposure Scenario RFETS PPRGs

**Sources**

(1) Ingestion Rate based upon open-space recreational user wading at Denver's Lowry Landfill Superfund Site (50 mL/day, RME, 25 mL/day, CT) For comparison, a single value of 35 mL/day is specified for DOE's Fernald Site (wading in shallow Paddy's Run)

(2) Exposure Time based upon DOE's Fernald Site recreational use (0.5 hr/day, CT) and on the Clear Creek/Central City Superfund Site recreational user (1.0 hr/day, RME, assuming that wading time would be the same as swimming time)  
EPA, 1991a = U.S. Environmental Protection Agency 1991 Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals Interim Office of Emergency and Remedial Response, Washington, D.C. Publication 9285-7-01B December  
EPA, 1991b = U.S. Environmental Protection Agency 1991 Human Health Evaluation Manual, Supplemental Guidance Standard Default Exposure Factor Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285-6-03 March 25  
Jeffco, 1996 = Jefferson County Parks and Open Space Study, Jefferson County, CO 1996

Table 4 Open Space Surface Soil Exposure Scenario RFETS PPRGs

The Open Space Surface Soil Exposure Scenario consists of the following pathways: inhalation of surface soil particulates and incidental ingestion of surface soil for an open space visitor who recreates at the site for 30 years including six years as a child. The open space receptor visits the site 100 times per year. This scenario includes only pathways that were evaluated in the Rocky Flats Cleanup Agreement (RFCA) to derive action levels.

Exposure Parameter	Variable	Unit	Value	Source
<b>General Assumptions</b>				
Target hazard index	THI	--	1	EPA, 1991a
Target excess lifetime cancer risk	TR	--	1E-06	EPA, 1991a
Adult body weight	BW	kg	70	EPA, 1991b
Child body weight	BWc	kg	15	EPA, 1991b
<b>Open Space Exposure Scenario Assumptions</b>				
Averaging time - noncarcinogenic	AT_NC	yr	30	EPA, 1991b
Averaging time - carcinogenic	AT_C	yr	70	EPA, 1991b
Exposure time	ET	hr/day	2.5	JeffCo, 1996
Exposure frequency	EF	day/yr	100	JeffCo, 1996
Exposure duration (adult and child, combined)	ED	yr	30	EPA, 1991b
Exposure duration (adult)	EDa	yr	24	EPA, 1991b
Exposure duration (child)	EDc	yr	6	EPA, 1991b
Inhalation rate	IRa_h	m <sup>3</sup> /hr	1.7	EPA, 1997, JeffCo, 1996
Inhalation rate = [IRa_h x ET]	IRa	m <sup>3</sup> /day	4.25	Calculated
Particulate Emission Factor	PEF	m <sup>3</sup> /kg	1.32E+09	EPA, 1996
Soil ingestion rate (adult)	IRs_a	mg/day	50	EPA, 1995
Soil ingestion rate (child)	IRs_c	mg/day	100	(1)
Age-adjusted soil ingestion factor = [(IRs_a x EDa) / BW] + [(IRs_c x EDc) / BWc]	IFs	mg-yr/kg-day	57	EPA, 1991a
Age-adjusted soil ingestion factor - radiation = (IRs_a x EDa) + (IRs_c x EDc)	IFs_RAD	mg-yr/day	1,800	EPA, 1991a
Gamma shielding factor	Se	--	0	EPA, 1991a
Gamma exposure factor (annual) = (EF / 365 day/yr) [a]	Te_A	--	2.74E-01	EPA, 1991a, JeffCo, 1996
Gamma exposure factor (daily) = (ET / 24 hr/day)	Te_D	--	1.04E-01	EPA, 1991a, JeffCo, 1996
<b>Toxicity Values</b>				
Oral reference dose	RfDo	mg/kg-day	chemical-specific	--
Oral slope factor	SfO	(mg/kg-day) <sup>-1</sup>	chemical-specific	--
Ingestion slope factor - radiological effects	SfORAD	risk/pCi	chemical-specific	--
Inhalation reference dose	RfDi	mg/kg-day	chemical-specific	--
Inhalation slope factor	SfI	(mg/kg-day) <sup>-1</sup>	chemical-specific	--

Table 4 Open Space Surface Soil Exposure Scenario RFETS PPRGs

Inhalation slope factor - radiological effects	SF <sub>IRAD</sub>	nsk/pCi	chemical-specific
External exposure slope factor	SF <sub>e</sub>	(nsk/yr per pCi/g)	chemical-specific
			--
			--
<b>Risk-Based PPRG</b>			
<b>Open Space Surface Soil Exposure Scenario-Noncarcinogenic Effects</b>			
PPRG (mg/kg) = (THI x AT_NC x 365 d/yr) / (EF x ((IRa x ED x 1/RfD) x 1/BW x 1/PEF) + (1/RfDo x 1E-06 kg/mg x IFs))			
<b>Open Space Surface Soil Exposure Scenario-Carcinogenic Effects</b>			
PPRG (mg/kg) = ((TR x AT_C x 365d/yr) / EF x ((SFI x IRa x ED x 1/BW x 1/PEF) + (1E-06 kg/mg x IFs x SFo)))			
<b>Open Space Surface Soil Exposure Scenario-Radiological Effects</b>			
PPRG (pCi/g) = TR / ((ED x EF x IRa x SF <sub>IRAD</sub> x 10 <sup>3</sup> g/kg x 1/PEF) + (EF x SF <sub>ORAD</sub> x 1E-03 g/mg x IFs <sub>IRAD</sub> ) + (ED x SF <sub>e</sub> x (1-Se) x (Te_A x Te_D)))			

**Notes.**

[a] Extrapolated to calculate annual exposure

**Sources.**

(1) Based on the assumption that outdoor ingestion of soil accounts for one-half the daily residential intake (200 mg/day for children, as cited in EPA (1991b))  
EPA, 1991a = U S Environmental Protection Agency 1991 Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals Interim Office of Emergency and Remedial Response, Washington, D C Publication 9285 7-01B December  
EPA, 1991b = U S Environmental Protection Agency 1991 Human Health Evaluation Manual, Supplemental Guidance Standard Default Exposure Factors Office of Solid Waste and Emergency Response, Washington, D C OSWER Directive 9285 6-03 March 25  
EPA, 1995 = U S Environmental Protection Agency Baseline Human Health Risk Assessment for the California Gulch Superfund Site Part C Screening-level Soil Concentrations for Workers and Recreational Site Visitors Exposed to Lead and Arsenic February Prepared for EPA Region VIII, Denver, CO by Roy F Weston, Inc  
EPA, 1996 = U S Environmental Protection 1996 Soil Screening Guidance Technical Background Document Office of Emergency and Remedial Response, Washington, D C EPA/540/R-95/128 May  
EPA, 1997 = U S Environmental Protection Agency 1997 Exposure Factors Handbook. Office of Research and Development, Washington, D C EPA/600/P-95/002Fa August  
JeffCo, 1996 = Jefferson County Parks and Open Space Study Jefferson County, CO 1996

Table 5 Toxicity Values Used for the RFETS PPRGs

Target Analyte List Chemical	CAS Number	Oral RfD (mg/kg-day)	Oral/Ingestion Slope Factor (mg/kg-day) <sup>-1</sup>	Inhal RfC (mg/m <sup>3</sup> )	Inhalation Unit Risk (m <sup>3</sup> /μg)	Inhalation RfD (mg/kg-day)	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	External Slope Factor (risk/yr pCi/g)
Acenaphthene	(V) 83-32-9	6 00E-02						
Acenaphthylene	(V) 208-96-8							
Acetone	(V) 67-64-1	1 00E-01						
Aldrin	308-00-2	3 00E-05	1 70E+01		4 90E 03	1 00E-03 y	1 70E+01 b	
Aluminum	7429-90-5	1 00E+00 y		5 00E-03 y				
Anthracene	(V) 120-12-7	3 00E-01						
Anilimony	7440-38-0	4 00E-04						
Aroclor 1016	12674-11-2	7 00E-05	2 00E+00 c,q		5 70E 04 c,q		2 00E+00 c,q	
Aroclor 1221	11104-28-2		2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Aroclor 1232	11141-16-5		2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Aroclor 1242	53469-21-9		2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Aroclor 1248	12672-29-6		2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Aroclor 1254	11097-69-1	2 00E-05	2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Aroclor 1260	11096-82-5		2 00E+00 c,q		5 70E-04 c,q		2 00E+00 c,q	
Arsenic	7440-38-2	3 00E-04	1 50E+00 i		4 30E-03		1 51E+01	
Banum	7440-39-3	7 00E-02		5 00E-04 b		1 43E-04 b		
Benzene	(V) 71-43-2	3 00E-03 y	2 80E-02	6 00E-03 y	7 80E-06 dd		2 73-02	
alpha-BHC	319-84-6		6 30E+00		1 80E-03		6 30E+00 b	
beta-BHC	319-85-7		1 80E+00		5 30E-04		1 80E+00 b	
delta-BHC	319-86-8							
gamma-BHC (Lindane)	58-89-9	3 00E-04	1 30E+00 b					
Benzo(a)anthracene	56-55-3		7 30E-01 k		8 80E-02 y		3 10E-01 y	
Benzo(a)pyrene	50-32-8		7 30E+00		8 80E-01 y		3 10E+00 y	
Benzo(b)fluoranthene	205-99-2		7 30E-01 k		8 80E-02 y		3 10E-00 y	
Benzo(g,h,i)perylene	191-24-2							
Benzo(k)fluoranthene	207-08-9		7 30E-02 k		8 80E-03 y		3 10E-02 y	
Benzic Acid	65-85-0	4 00E+00						
Benzyl Alcohol	100-51-6	3 00E-01 b						
Beryllium	7440-41-7	2 00E-03	4 30E+00 w	2 00E-05	2 40E-03	5 71E-06	8 40E+00 b	
bis(2-chloroethoxy)methane	(V) 111-91-1							
bis(2-chloroethyl)ether	(V) 111-44-4		1 10E+00		3 30E-04		1 10E+00 b	
bis(2-chloroisopropyl)ether	(V) 38638-32-9	4 00E-02	7 00E-02 b,u		1 00E-05 b,u		3 50E-02 b,u	
bis(2-ethylhexyl)phthalate	117-81-7	2 00E-02	1 40E-02				1 40E-02 y	
Bromodichloromethane	(V) 75-27-4	2 00E-02	6 20E-02					
Bromoform	(V) 75-25-2	2 00E-02	7 9E-03		1 10E-06		3 90E-03	
Bromomethane	(V) 74-83-9	1 40E-03		5 00E-03		1 43E-03		
4-Bromophenyl phenyl ether	101-55-3							
2-Butanone	(V) 78-93-3	6 00E-01		1 00E+00		2 86E-01		
Butylbenzylphthalate	85-88-7	2 00E-01						
Cadmium (water)	7440-43-9	5 00E-04 r			1 80E-03		6 30E+00	
Cadmium (food)	7440-43-9	1 00E-03 r		3 00E-04 ee	1 80E-03	8 60E-05 ee	6 30E+00	
Calcium	7440-70-2							

Table 5 Toxicity Values Used for the RfETs PPRGs

Target Analyte List Chemical	CAS Number	Oral RfD (mg/kg-day)	Oral/Ingestion Slope Factor (mg/kg-day) <sup>-1</sup>	Inhal RfC (mg/m <sup>3</sup> )	Inhalation Unit Risk (m <sup>3</sup> /μg)	Inhalation RfD (mg/kg-day)	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	External Slope Factor (risk/yr per pCi/g)
Carbon disulfide	(V) 75-15-0	1 00E-01		7 00E-01		2 00E-01		
Carbon tetrachloride	(V) 56-23-5	7 00E-04	1 30E-01	2 00E-03 y	1 05E-05	5 71E-04 y	5 30E-02 b	
Cesium	7440-46-2							
alpha-Chlordane	5103-71-9	5 00E-04 d	3 50E-01 d	7 00E-04 d	1 00E-04 d	2 00E-04 d	3 50E-01 d	
beta-Chlordane	5103-74-2	5 00E-04 d	3 50E-01 d	7 00E-04 d	1 00E-04 d	2 00E-04 d	3 50E-01 d	
gamma-Chlordane	12789-03-6	5 00E-04	3 50E-01	7 00E-04	1 00E-04	2 00E-04	3 50E-01	
4-Chloroaniline	106-47-8	4 00E-03						
Chlorobenzene	(V) 108-90-7	2 00E-02		2 00E-02 b		5 71E-03 b		
Chloroethane	(V) 75-00-3	4 00E-01 y	2 90E-03 y	1 00E-01		2 86E+00		
Chloroform	(V) 67-66-3	1 00E-02	6 10E-03	3 00E-04 y	2 30E-05		8 05E-02	
Chloromethane	(V) 74-87-3		1 30E-02 b		1 80E-06 b		6 30E-03 b	
4-Chloro-3-methylphenol	59-50-7							
2-Chloronaphthalene	(V) 91-58-7	8 00E-02						
2-Chlorophenol	(V) 95-57-8	5 00E-03						
4-Chlorophenyl phenyl ether	7005-72-3							
Chromium III	16065-83-1	1 50E+00						
Chromium VI	18540-29-9	3 00E-03		1 00E-04 ff	1 20E-02	5 71E-07 w,y	4 20E+01	
Chrysene	218-01-9	6 00E-02 y,b	7 30E-03 k		8 80E-04 y		3 10E-03 y	
Cobalt	7440-48-4	3 70E-02 w,o						
Copper	7440-50-8	2 00E-02						
Cyanide	57-12-5							
4,4-DDD	72-54-8		2 40E-01					
4,4-DDE	72-55-9		3 40E-01					
4,4-DDT	50-29-3	5 00E-04	3 40E-01		9 70E-05		3 40E-01	
Dibenz(a,h)anthracene	53-70-3	4 00E-03 y	7 30E+00 k		8 80E-01 y		3 10E+00 y	
Dibenzofuran	132-64-9	2 00E-02	8 40E-02					
Dibromochloromethane	124-48-1	1 00E-01						
Di-n-butylphthalate	84-74-2	9 00E-02		2 00E-01 b		5 70E-02		
1,2-Dichlorobenzene	(V) 95-50-1	9 00E-02						
1,3-Dichlorobenzene	(V) 541-73-1	9 00E-04 y						
1,4-Dichlorobenzene	(V) 106-46-7	3 00E-02 y,cc	2 40E-02 b	8 00E-01		2 30E-01		
3,3-Dichlorobenzidine	91-94-1		4 50E-01					
1,1-Dichloroethane	(V) 75-34-3	1 00E-01 b		5 00E-01 b		1 43E-01		
1,2-Dichloroethane	(V) 107-06-2	3 00E-02 y	9 10E-02	5 00E-03 y	2 60E-05	1 40E-03 y	9 10E-02	
1,1-Dichloroethene	(V) 75-35-4	9 00E-03	6 00E-01		5 00E-05		1 75E-01	
1,2-Dichloroethene (total)	(V) 540-59-0	9 00E-03 b						
2,4-Dichlorophenol	120-83-2	3 00E-03						
1,2-Dichloropropane	(V) 78-87-5		6 80E-02 b	4 00E-03		1 14E-03		
cis-1,3-Dichloropropene	(V) 10081-01-5	3 00E-04 e	1 80E-01 b,e	2 00E-02 e	3 70E-05 b,e	5 71E-03 e	1 30E-01 b,e	
trans-1,3-Dichloropropene	(V) 10061-02-6	3 00E-04 e	1 80E-01 b,e	2 00E-02 e	3 70E-05 b,e	5 71E-03 e	1 30E-01 b,e	
Dieldrin	60-57-1	5 00E-05	1 60E+01		4 60E-03		1 60E+01	
Diethylphthalate	84-68-2	8 00E-01						

Table 5 Toxicity Values Used for the RFETS PPRGs

Target Analyte List Chemical	CAS Number	Oral RfD (mg/kg-day)	Oral/Ingestion Slope Factor (mg/kg-day) <sup>-1</sup>	Inhal RfC (mg/m <sup>3</sup> )	Inhalation Unit Risk (m <sup>3</sup> /μg)	Inhalation RfD (mg/kg-day)	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	External Slope Factor (risk/yr per pCi/g)
2,4-Dimethylphenol	105-67-9	2 00E-02						
Dimethylphthalate	131-11-3	1 00E-01 w,y						
4,6-Dinitro-2 methylphenol	534-52-1	1 00E-04 y						
2,4-Dinitrophenol	51-28-5	2 00E-03						
2,4-Dinitrotoluene	121-14-2	2 00E-03	6 80E-01					
2,6-Dinitrotoluene	606-20-2	1 00E-03 b	6 80E-01					
Di-n-octylphthalate	117-84-0	2 00E-02 b	1 40E-02		4 00E-06 y			
Endosulfan I	959-98-8	6 00E-03 z						
Endosulfan II	33213-65-9	6 00E-03 z						
Endosulfan sulfate	1031-07-8	6 00E-03 z						
Endosulfan (technical)	115-29-7	6 00E-03						
Endrin ketone	53494-70-5							
Endrin (technical)	72-20-8	3 00E-04						
Ethylbenzene	100-41-4	1 00E-01		1 00E+00		2 86E-01		
Fluoranthene	208-44-0	4 00E-02						
Fluorene	86-73-7	4 00E-02						
Heptachlor	76-44-8	5 00E-04	4 50E+00		1 30E-03		4 50E+00	
Heptachlor epoxide	1024-57-3	1 30E-05	9 10E+00		2 60E-03		9 10E+00	
Hexachlorobenzene	118-74-1	8 00E-04	1 60E+00		4 60E-04		1 60E+00	
Hexachlorobutadiene	87-68-3	2 00E-04 b	7 80E-02		2 20E-05		7 70E-02	
Hexachlorocyclopentadiene	77-47-4	7 00E-03		7 00E-05 b		2 00E-05 b		
Hexachloroethane	67-72-1	1 00E-03	1 40E-02		4 00E-06		1 40E-02	
2-Hexanone	591-78-6							
Indeno(1,2,3-cd)pyrene	193-39-5		7 30E-01 k		8 80E-02 y		3 10E-01 y	
Iron	7439-89-6	3 00E-01 y						
Isophorone	78-59-1	2 00E-01	9 50E-04					
Lead	7439-92-1							
Lithium	7439-93-2	2 00E-02 w,y						
Magnesium	7439-95-4							
Manganese	7439-96-5	4 70E-02 s		5 00E-05		1 43E-05		
Mercury (elemental)	7439-97-6	gg		3 00E-04 b		8 60E-05 j		
Mercuric chloride		3 00E-04 gg						
Methoxychlor	72-43-5	5 00E-03						
Methylene chloride	75-09-2	6 00E-02	7 50E-03	3 00E+00 b	4 70E-07	8 57E 01	1 65E-03	
2-Methylnaphthalene	91-57-6	2 00E-02 y,aa						
4-Methyl-2-pentanone	108-10-1	8 00E-02 b		8 00E-02 b		2 29E-02		
2-Methylphenol	95-48-7	5 00E-02						
4-Methylphenol	106-44-5	5 00E-03 b						
Molybdenum	7439-98-7	5 00E-03						
Naphthalene	91-20-3	2 00E-02		3 00E-03				
Nickel (soluble)	7440-02-0	2 00E-02						
2-Nitroaniline	88-74-4	6 00E-05 w,y		2 00E-04		5 71E-05		

Table 5 Toxicity Values Used for the RFETS PPRGs

Target Analyte List Chemical	CAS Number	Oral RfD (mg/kg-day)	Oral/Ingestion Slope Factor (mg/kg-day) <sup>-1</sup>	Inhal RfC (mg/m <sup>3</sup> )	Inhalation Unit Risk (m <sup>3</sup> /μg)	Inhalation RfD (mg/kg-day)	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	External Slope Factor (risk/yr per pCi/g)
3-Nitroaniline	99-09-2							
4-Nitroaniline	100-01-6							
Nitrobenzene	(N) 98-95-3	5 00E-04		2 00E-03 b		5 70E-04 i		
2-Nitrophenol	88-75-5							
4-Nitrophenol	(N) 100-02-7	8 00E-03 y						
n-Nitrosodiphenylamine	(N) 86-30-6		4 90E-03					
n-Nitrosodipropylamine	621-64-7		7 00E+00					
Pentachlorophenol	87-86-5	3 00E-02	1 20E-01					
Phenanthrene	(N) 85-01-8							
Phenol	108-95-2	6 00E-01						
Potassium	7440-09-7							
Pyrene	129-00-0	3 00E-02						
Selenium	7782-49-2	5 00E-03						
Silver	7440-22-4	5 00E-03						
Sodium	7440-23-5							
Strontium	7440-24-8	6 00E-01						
Styrene	(N) 100-42-5	2 00E-01		1 00E+00		2 86E-01		
1,1,2,2-Tetrachloroethane	(N) 79-34-5	6 00E-02 y	2 00E-01		5 80E-05		2 00E-01 b	
Tetrachloroethene	(N) 127-18-4	1 00E-02	5.20E-02 y	6 00E-01 y	5 80E-07 y		2 03E-03 i	
Thallium	7440-28-0							
Tin	7440-31-5	6 00E-01 b						
Toluene	(N) 108-88-3	2 00E-01		4 00E-01		1 14E-01		
Toxaphene	8001-35-2		1 10E+00		3 20E-04		1 10E+00	
1,2,4-Trichlorobenzene	(N) 120-82-1	1 00E-02		2 00E-01 b		5 71E-02 i		
1,1,1-Trichloroethane	(N) 71-55-6	2.80E-01 y		2 20E+00 y		2 86E-01 w,y		
1,1,2-Trichloroethane	(N) 79-00-5	4 00E-03	5 70E-02		1 60E-05		5 60E-02	
Trichloroethene	(N) 79-01-6	6 00E-03 y	1 10E-02 w		1 70E-06 i		6 00E-03 i	
2,4,5-Trichlorophenol	95-95-4	1 00E-01						
2,4,6-Trichlorophenol	88-08-2		1 10E-02		3 10E-06		1 00E-02	
Vanadium	7440-62-2	7 00E-03 b						
Vinyl acetate	108-05-4	1 00E+00 b		2 00E-01		5 71E-02		
Vinyl chloride	(N) 75-01-4		1 80E+00 b		8 40E-05 b		3 00E-01	
Xylene (total)	(N) 1330-20-7	2 00E+00						
Zinc	7440-66-6	3 00E-01						
Nitrate	14797-55-8	1 60E+00						
Nitrite	14797-65-0	1 00E-01						
Sulfide	18496-25-8							
Ammonium (as Ammonia)	7664-41-7	9 70E-01 x		1 00E-01		2 86E-02		
Bicarbonate	71-52-3							
Bromide	24959-67-9							

Table 5 Toxicity Values Used for the RFETS PPRGs

Target Analyte List Chemical	CAS Number	Oral RfD (mg/kg-day)	Oral/Ingestion Slope Factor (mg/kg-day) <sup>-1</sup>	Inhal RfC (mg/m <sup>3</sup> )	Inhalation Unit Risk (m <sup>3</sup> /μg)	Inhalation RfD (mg/kg-day)	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	External Slope Factor (risk/yr per pCi/g)
Carbonate	3812-32-6							
Chloride	16887-00-6							
Fluoride (as fluoride)	7782-41-4	6 00E-02						
Orthophosphate	14265-44-2							
Silica (as Si and SiO <sub>2</sub> )	7631-86-9							
Sulfate	14808-79-8							
Am-241	14596-10-2		3 28E-10 b				3 85E-08 b	4 59E-09 b
Cs-137+D	10045-97-3(+D)		3 16E-11 b				1 91E-11 b	2 09E-06 b
Pu-239	15117-48-3		3 16E-10 b				2 78E-08 b	1 26E-11 b
Pu-240	14119-33-6		3 15E-10 b				2 78E-08 b	1 87E-11 b
Ra-226+D	13982-63-3(+D)		2 98E-10 b				2 75E-09 b	6 74E-06 b
Ra-228+D	15282-20-1(+D)		2 48E-10 b				9 94E-10 b	3 28E-06 b
Sr-89	14156-27-1		1 03E-11 b				3 68E-12 b	5 38E-10 b
Sr-90+D	10098-87-2(+D)		5 59E-11 b				6 93E-11 b	0 00E+00 b
Th-232	10028-17-8		7 15E-14 b				9 59E-14 b	0 00E+00 b
U-233	13968-55-3		4 48E-11 b				1 41E-08 b	3 52E-11 b
U-234	13966-28-5		4 44E-11 b				1 40E-08 b	2 14E-11 b
U-235+D	15117-98-1(+D)		4 70E-11 b				1 30E-08 b	2 65E-07 b
U-238+D	7440-61-1(+D)		6 20E-11 b				1 24E-08 b	6 57E-08 b

Notes

(V) = Chemicals listed are  
volatile

a = All toxicity values and notes are from IRIS, 1999 unless otherwise noted Several inhalation slope factors have

been derived by multiplying the inhalation unit risk from IRIS by a conversion factor of 3500 [SFI = (Inh Unit Risk x 70kg x 1,000 ug/mg) / 20 m<sup>3</sup>/d]

Several inhalation reference doses have been derived by multiplying the inhalation reference concentration by a conversion factor of 0 2857 [RfD<sub>i</sub> = (RfC<sub>i</sub> x 20 m<sup>3</sup>/d) / 70 kg]

Several oral slope factors have been derived by multiplying the drinking water unit risk by a conversion factor of 35,000 [SFO = (DW Unit Risk x 70 kg x 1,000 ug/mg) / 2 L/day]

b = Value from HEAST, 1997

c = Values given are for PCBs

d = Values given are for chlordane (CAS no 12789-03-6)

e = Values given are for 1,3-dichloropropene

i = Value given for arsenic is calculated from an oral unit risk of 5E-05 (L/μg)

j = Values given for chemicals were calculated from HEAST, 1997

k = Values given for PAHs were found in EPA, 1993

l = Value given is from an EPA memo from the Office of Research and Development, National Center for Environmental Assessment (NCEA)

o = Value based on the copper drinking water standard of 1 3 mg/L

q = The upper-bound slope factor for high risk and persistence is recommended by EPA for the oral slope factor of PCB environmental mixtures

Table 5 Toxicity Values Used for the RFEETS PPRGs

r = Dual oral RfDs available for cadmium 5E-04 is representative of pathways involving water and 1E-03 is representative of pathways involving food (soil)  
s = According to IRIS, 1998, the oral RfD of 0.14 represents total oral intake of manganese It is recommended that a modifying factor of three be applied (resulting oral RfD = 0.047) If oral RfD is used for assessments involving nondietary exposures (Ingesting soil or drinking water)  
u = Values given for 70 percent bis(2-chloro-1-methyl ethyl) ether and 30 percent bis(2-chloroisopropyl) ether  
w = Value given has been withdrawn by EPA, greater uncertainty is associated with this toxicity value than values listed in IRIS and HEAST  
x = Ammonia oral RfD specifically related to organoleptic threshold  
y = NCEA (as referenced in EPA, 1997)  
z = Values given for Endosulfan (technical)  
aa = Value is for naphthalene NCEA, 1999 recommends using the RfD for naphthalene as a surrogate for its methylated derivative, 2-methylnaphthalene until additional studies are available  
bb = Value is upper range of average intake for children, recommended by NCEA, 1999 in lieu of an oral RfD, given the relatively well characterized intake of cobalt in food  
cc = Value given is the higher of two possible provisional RfDs provided by NCEA Higher value was chosen for more conservatism  
dd = Value given is the high end of the range provided of acceptable URIFs This value was chosen for more conservatism  
ee = Value given is Region VIII EPA RfC for cadmium  
ff = Value given is IRIS RfC for chromium VI in particulates, the likely form in RFEETS soils  
gg = Elemental mercury and ionic mercury have been separated to reflect reporting in IRIS

#### References

EPA, 1993 = U.S. Environmental Protection Agency 1993 Research and Development-Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons Prepared for the Office of Health and Environmental Assessment by the Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH Final Draft ECAO-CIN-842 March  
EPA, 1997 = U.S. Environmental Protection Agency 1997 Region III Risk-Based Concentration Table Philadelphia, PA. October 22  
HEAST, 1997 = U.S. Environmental Protection Agency 1997 Health Effects Assessment Summary Tables, FY-1997 Annual Office of Solid Waste and Emergency Response, Washington, D.C. EPA/540/R-97/036 July  
IRIS, 1998 = U.S. Environmental Protection Agency 1998 Integrated Risk Information System On-line database Office of Research and Development, Cincinnati, OH April

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

Target Analyte List Chemical	CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
Acenaphthene	(V) 83-32-9	2 19E+00	1 23E+05	3 07E+02	1 15E+05
Acenaphthylene	(V) 208-96-8	-	-	-	-
Acetone	(V) 67-64-1	3 65E+00	2 04E+05	5 11E+02	1 92E+05
Aldrin	308-00-2	5 01E-06	3 37E-01	7 01E-04	2 64E-01
Aluminum	7429-90-5	3 65E+01	>1E+06	5 11E+03	>1E+06
Anthracene	(V) 120-12-7	1 10E+01	6 13E+05	1 63E+03	5 76E+05
Antimony	7440-36-0	1 46E-02	8 18E+02	2 04E+00	7 68E+02
Aroclor 1016	12674-11-2	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1221	11104-28-2	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1232	11141-16-5	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1242	53469-21-9	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1248	12672-29-6	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1254	11097-69-1	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Aroclor 1260	11096-82-5	4 26E-05	2 86E+00	5 96E-03	2 24E+00
Arsenic	7440-38-2	5 68E-05	3 81E+00	7 95E-03	2 99E+00
Barium	7440-39-3	2 56E+00	1 34E+05	3 58E+02	1 33E+05
Benzene	(V) 71-43-2	2 94E-03	1 97E+02	4 11E-01	1 55E+02
alpha-BHC	319-84-6	1 35E-05	9 08E-01	1 89E-03	7 11E-01
beta-BHC	319-85-7	4 73E-05	3 18E+00	6 62E-03	2 49E+00
delta-BHC	319-86-8	-	-	-	-
gamma-BHC (Lindane)	58-89-9	6 55E-05	4 40E+00	9 17E-03	3 45E+00
Benzo(a)anthracene	56-55-3	1 17E-04	7 84E+00	1 63E-02	6 14E+00
Benzo(a)pyrene	50-32-8	1 17E-05	7 84E-01	1 63E-03	6 14E-01
Benzo(b)fluoranthene	205-99-2	1 17E-04	7 84E+00	1 63E-02	6 14E+00
Benzo(g,h,i)perylene	191-24-2	-	-	-	-
Benzo(k)fluoranthene	207-08-9	1 17E-03	7 84E+01	1 63E-01	6 14E+01
Benzoic Acid	65-85-0	1 46E+02	>1E+06	2 04E+04	>1E+06
Benzyl Alcohol	100-51-6	1 10E+01	6 13E+05	1 53E+03	5 76E+05
Beryllium	7440-41-7	1 98E-05	1 33E+00	2 77E-03	1 04E+00
bis(2-chloroethoxy)methane	(V) 111-91-1	-	-	-	-

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Target Analyte List Chemical	CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
bis(2-chloroethyl)ether	(V) 111-44-4	7 74E-05	5 20E+00	1 08E-02	4 07E+00
bis(2-chloroisopropyl)ether	(V) 39638-32-9	1 22E-03	8 18E+01	1 70E-01	6 40E+01
bis(2-ethylhexyl)phthalate	(V) 117-81-7	6 08E-03	4 09E+02	8 52E-01	3 20E+02
Bromodichloromethane	(V) 75-27-4	1 37E-03	9 23E+01	1 92E-01	7 23E+01
Bromoform	(V) 75-25-2	1 08E-02	7 24E+02	1 51E+00	5 67E+02
Bromomethane	(V) 74-83-9	5 11E-02	2 86E+03	7 15E+00	2 89E+03
4-Bromophenyl phenyl ether	(V) 101-55-3	-	-	-	-
2-Butanone	(V) 78-83-3	2 19E+01	>1E+06	3 07E+03	>1E+06
Butylbenzylphthalate	(V) 85-68-7	7 30E+00	4 09E+05	1 02E+03	3 84E+05
Cadmium (water)	(V) 7440-43-9	1 83E-02	NA	2 56E+00	NA
Cadmium (food)	(V) 7440-43-9	NA	2 04E+03	5 11E+00	1 92E+03
Calcium	(V) 7440-70-2	-	-	-	-
Carbon disulfide	(V) 75-15-0	3 65E+00	2 04E+05	5 11E+02	1 92E+05
Carbon tetrachloride	(V) 56-23-5	6 55E-04	4 40E+01	9 17E-02	3 45E+01
Cesium	(V) 7440-46-2	-	-	-	-
alpha-Chlordane	(V) 5103-71-9	2 43E-04	1 63E+01	3 41E-02	1 28E+01
beta-Chlordane	(V) 5103-74-2	2 43E-04	1 63E+01	3 41E-02	1 28E+01
gamma-Chlordane	(V) 12789-03-6	2 43E-04	1 63E+01	3 41E-02	1 28E+01
4-Chloroaniline	(V) 106-47-8	1 46E-01	8 18E+03	2 04E+01	7 68E+03
Chlorobenzene	(V) 108-90-7	7 30E-01	4 09E+04	1 02E+02	3 84E+04
Chloroethane	(V) 75-00-3	2 94E-02	1 97E+03	4 11E+00	1 56E+03
Chloroform	(V) 67-66-3	1 40E-02	9 38E+02	1 95E+00	7 35E+02
Chloromethane	(V) 74-87-3	6 55E-03	4 40E+02	9 17E-01	3 45E+02
4-Chloro-3-methylphenol	(V) 59-50-7	-	-	-	-
2-Chloronaphthalene	(V) 91-58-7	2 92E+00	1 64E+05	4 09E+02	1 54E+05
2-Chlorophenol	(V) 95-57-8	1 83E-01	1 02E+04	2 56E+01	9 61E+03
4-Chlorophenyl phenyl ether	(V) 7005-72-3	-	-	-	-
Chromium III	(V) 16065-83-1	5 48E+01	8 73E+03	7 67E+03	4 46E+04
Chromium VI	(V) 18540-29-9	1 10E-01	1 02E+03	1 53E+01	4 41E+03
Chrysene	(V) 218-01-9	1 17E-02	7 84E+02	1 63E+00	6 14E+02
Cobalt	(V) 7440-48-4	2 19E+00	1 23E+05	3 07E+02	1 15E+05
Copper	(V) 7440-50-8	1 35E+00	7 56E+04	1 89E+02	7 11E+04

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

Target Analyte List Chemical	CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
Cyanide	57-12-5	7 30E-01	4 09E+04	1 02E+02	3 84E+04
4,4-DDD	72-54-8	3 55E-04	2 38E+01	4 97E-02	1 87E+01
4,4-DDE	72-55-9	2 50E-04	1 68E+01	3 51E-02	1 32E+01
4,4-DDT	50-29-3	2 50E-04	1 68E+01	3 51E-02	1 32E+01
Dibenz(a,h)anthracene	53-70-3	1 17E-05	7 84E-01	1 63E-03	6 14E-01
Dibenzofuran	132-84-9	1 48E-01	8 18E+03	2 04E+01	7 68E+03
Dibromochloromethane	124-48-1	1 01E-03	6 81E+01	1 42E-01	5 34E+01
Di-n-butylphthalate	84-74-2	3 65E+00	2 04E+05	5 11E+02	1 92E+05
1,2-Dichlorobenzene	95-50-1	3 29E+00	1 84E+05	4 60E+02	1 73E+05
1,3-Dichlorobenzene	541-73-1	3 29E-02	1 84E+03	4 60E+00	1 73E+03
1,4-Dichlorobenzene	108-46-7	3 55E-03	2 38E+02	4 97E-01	1 87E+02
3,3-Dichlorobenzidine	91-84-1	1 89E-04	1 27E+01	2 65E-02	9 96E+00
1,1-Dichloroethane	75-34-3	3 65E+00	2 04E+05	5 11E+02	1 92E+05
1,2-Dichloroethane	107-06-2	9 36E-04	6 29E+01	1 31E-01	4 93E+01
1,1-Dichloroethene	75-35-4	1 42E-04	9 54E+00	1 99E-02	7 47E+00
1,2-Dichloroethene (total)	540-59-0	3 29E-01	1 84E+04	4 60E+01	1 73E+04
2,4-Dichlorophenol	120-83-2	1 10E-01	6 13E+03	1 53E+01	5 76E+03
1,2-Dichloropropane	78-87-5	1 25E-03	8 42E+01	1 75E-01	6 59E+01
cis-1,3-Dichloropropene	10061-01-5	4 73E-04	3 18E+01	6 62E-02	2 49E+01
trans-1,3-Dichloropropene	10061-02-6	4 73E-04	3 18E+01	6 62E-02	2 49E+01
Dieldrin	60-57-1	5 32E-06	3 58E-01	7 45E-04	2 80E-01
Diethylphthalate	84-68-2	2 92E+01	>1E+06	4 09E+03	>1E+06
2,4-Dimethylphenol	105-67-9	7 30E-01	4 09E+04	1 02E+02	3 84E+04
Dimethylphthalate	131-11-3	3 65E+02	>1E+06	5 11E+04	>1E+06
4,6-Dinitro-2-methylphenol	534-52-1	3 65E-03	2 04E+02	5 11E-01	1 92E+02
2,4-Dinitrophenol	51-28-5	7 30E-02	4 09E+03	1 02E+01	3 84E+03
2,4-Dinitrotoluene	121-14-2	1 25E-04	8 42E+00	1 75E-02	6 59E+00
2,6-Dinitrotoluene	608-20-2	1 25E-04	8 42E+00	1 75E-02	6 59E+00
Di-n-octylphthalate	117-84-0	6 08E-03	4 09E+02	8 52E-01	3 20E+02
Endosulfan I	959-98-8	2 19E-01	1 23E+04	3 07E+01	1 15E+04
Endosulfan II	33213-65-9	2 19E-01	1 23E+04	3 07E+01	1 15E+04
Endosulfan sulfate	1031-07-8	2 19E-01	1 23E+04	3 07E+01	1 15E+04

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

Target Analyte List Chemical	CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
Endosulfan (technical)	115-29-7	2 19E-01	1 23E+04	3 07E+01	1 15E+04
Endrin ketone	53494-70-5	-	-	-	-
Endrin (technical)	72-20-8	1 10E-02	6 13E+02	1 53E+00	5 76E+02
Ethylbenzene	100-41-4	3 65E+00	2 04E+05	5 11E+02	1 92E+05
Fluoranthene	206-44-0	1 46E+00	8 18E+04	2 04E+02	7 68E+04
Fluorene	86-73-7	1 46E+00	8 18E+04	2 04E+02	7 68E+04
Heptachlor	76-44-8	1 89E-05	1 27E+00	2 65E-03	9 96E-01
Heptachlor epoxide	1024-57-3	9 38E-06	6 29E-01	1 31E-03	4 93E-01
Hexachlorobenzene	118-74-1	5 32E-05	3 58E+00	7 45E-03	2 80E+00
Hexachlorobutadiene	87-68-3	1 09E-03	7 34E+01	1 55E-01	5 75E+01
Hexachlorocyclopentadiene	77-47-4	2 56E-01	1 37E+04	3 58E+01	1 33E+04
Hexachloroethane	67-72-1	6 08E-03	4 09E+02	8 52E-01	3 20E+02
2-Hexanone	591-78-6	-	-	-	-
Indeno(1,2,3-cd)pyrene	193-39-5	1 17E-04	7 84E+00	1 63E-02	6 14E+00
Iron	7439-89-6	1 10E+01	6 13E+05	1 53E+03	5 76E+05
Isophorone	78-59-1	8 96E-02	6 02E+03	1 26E+01	4 72E+03
Lead	7439-82-1	-	1 00E+03 [a]	-	-
Lithium	7439-93-2	7 30E-01	4 09E+04	1 02E+02	3 84E+04
Magnesium	7439-95-4	-	-	-	-
Manganese	7439-96-5	1 72E+00	6 68E+04	2 40E+02	8 36E+04
Mercury (elemental)	7439-97-6	-	>1E+06	-	>1E+06
Mercuric chloride	[b]	1 10E-02	6 13E+02	1 53E+00	5 76E+02
Methoxychlor	72-43-5	1 83E-01	1 02E+04	2 56E+01	9 61E+03
Methylene chloride	75-09-2	1 14E-02	7 63E+02	1 59E+00	5 98E+02
2-Methylnaphthalene	91-57-6	7 30E-01	4 09E+04	1 02E+02	3 84E+04
4-Methyl-2-pentanone	108-10-1	2 92E+00	1 64E+05	4 09E+02	1 54E+05
2-Methylphenol	95-48-7	1 83E+00	1 02E+05	2 56E+02	9 61E+04
4-Methylphenol	108-44-5	1 83E-01	1 02E+04	2 56E+01	9 61E+03
Molybdenum	7439-98-7	1 83E-01	1 02E+04	2 56E+01	9 61E+03
Naphthalene	91-20-3	7 30E-01	4 09E+04	1 02E+02	3 84E+04
Nickel (soluble)	7440-02-0	7 30E-01	4 09E+04	1 02E+02	3 84E+04
2-Nitroaniline	88-74-4	2 19E-03	1 23E+02	3 07E-01	1 15E+02

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

Target Analyte List Chemical	CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
3-Nitroaniline	99-09-2	-	-	-	-
4-Nitroaniline	100-01-6	-	-	-	-
Nitrobenzene	98-95-3	1 83E-02	1 02E+03	2 56E+00	9 61E+02
2-Nitrophenol	88-75-5	-	-	-	-
4-Nitrophenol	100-02-7	2 92E-01	1 64E+04	4 09E+01	1 54E+04
n-Nitrosodiphenylamine	86-30-6	1 74E-02	1 17E+03	2 43E+00	9 15E+02
n-Nitrosodipropylamine	621-64-7	1 22E-05	8 18E-01	1 70E-03	6 40E-01
Pentachlorophenol	87-86-5	7 10E-04	4 77E+01	9 94E-02	3 74E+01
Phenanthrene	85-01-8	-	-	-	-
Phenol	108-95-2	2 19E+01	>1E+06	3 07E+03	>1E+06
Potassium	7440-09-7	-	-	-	-
Pyrene	129-00-0	1 10E+00	6 13E+04	1 53E+02	5 76E+04
Selenium	7782-49-2	1 83E-01	1 02E+04	2 56E+01	9 61E+03
Silver	7440-22-4	1 83E-01	1 02E+04	2 56E+01	9 61E+03
Sodium	7440-23-5	-	-	-	-
Strontium	7440-24-6	2 19E+01	>1E+06	3 07E+03	>1E+06
Stryene	100-42-5	7 30E+00	4 09E+05	1 02E+03	3 84E+05
1,1,2,2-Tetrachloroethane	79-34-5	4 26E-04	2 86E+01	5 96E-02	2 24E+01
Tetrachloroethene	127-18-4	1 64E-03	1 10E+02	2 29E-01	8 62E+01
Thallium	7440-28-0	-	-	-	-
Tin	7440-31-5	2 19E+01	>1E+06	3 07E+03	>1E+06
Toluene	108-88-3	7 30E+00	4 09E+05	1 02E+03	3 84E+05
Toxaphene	8001-35-2	7 74E-05	5 20E+00	1 08E-02	4 07E+00
1,2,4-Trichlorobenzene	120-82-1	3 65E-01	2 04E+04	5 11E+01	1 92E+04
1,1,1-Trichloroethane	71-55-6	1 02E+01	5 72E+05	1 43E+03	5 38E+05
1,1,2-Trichloroethane	79-00-5	1 49E-03	1 00E+02	2 09E-01	7 86E+01
Trichloroethene	79-01-6	7 74E-03	5 20E+02	1 08E+00	4 07E+02
2,4,5-Trichlorophenol	95-95-4	3 65E+00	2 04E+05	5 11E+02	1 92E+05
2,4,6-Trichlorophenol	88-06-2	7 74E-03	5 20E+02	1 08E+00	4 07E+02
Vanadium	7440-62-2	2 56E-01	1 43E+04	3 58E+01	1 34E+04
Vinyl acetate	108-05-4	3 65E+01	>1E+06	5 11E+03	>1E+06
Vinyl chloride	75-01-4	4 48E-05	3 01E+00	6 28E-03	2 36E+00

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

Target Analyte List Chemical		CAS Number	Residential Groundwater (mg/L or pCi/L)	Office Worker Soil (mg/kg or pCi/g)	Open Space Surface Water (mg/L or pCi/L)	Open Space Soil (mg/kg or pCi/g)
Xylene (total)	(V)	1330-20-7	7 30E+01	>1E+06	1 02E+04	>1E+06
Zinc		7440-68-6	1 10E+01	6 13E+05	1 53E+03	5 76E+05
Nitrate		14797-55-8	5 84E+01	>1E+06	8 18E+03	>1E+06
Nitrite		14797-65-0	3 65E+00	2 04E+05	5 11E+02	1 92E+05
Sulfide		18496-25-8	-	-	-	-
Ammonium (as Ammonia)		7664-41-7	3 54E+01	>1E+06	4 96E+03	>1E+06
Bicarbonate		71-52 3	-	-	-	-
Bromide		24959-67-9	-	-	-	-
Carbonate		3812-32-6	-	-	-	-
Chloride		16887-00-6	-	-	-	-
Fluoride (as fluoride)		7782-41-4	2 19E+00	1 23E+05	3 07E+02	1 15E+05
Orthophosphate		14265-44-2	-	-	-	-
Silica (as Si and SiO2)		7631-86-9	-	-	-	-
Sulfate		14808-79-8	-	-	-	-
Am-241		14596-10-2	1 45E-01	8 00E+00	2 03E+01	1 58E+01
Cs-137+D		10045-87-3(+D)	1 51E+00	1 05E-01	2 11E+02	5 57E-01
Pu-239		15117-48-3	1 51E-01	1 00E+01	2 11E+01	1 75E+01
Pu-240		14119-33-6	1 51E-01	1 00E+01	2 12E+01	1 75E+01
Ra-226+D		13982-63-3(+D)	1 81E-01	3 24E-02	2 25E+01	1 72E-01
Ra-228+D		15262-20-1(+D)	1 92E-01	6 64E-02	2 69E+01	3 51E-01
Sr-89		14158-27-1	4 62E+00	1 76E+02	6 47E+02	4 32E+02
Sr-90+D		10098-97-2(+D)	8 52E-01	5 72E+01	1 19E+02	9 94E+01
Tritium		10028-17-8	6 66E+02	4 47E+04	9 32E+04	7 77E+04
U-233		13968-55-3	1 06E+00	6 78E+01	1 49E+02	1 22E+02
U-234		13966-28-5	1 07E+00	6 87E+01	1 50E+02	1 23E+02
U-235+D		15117-96-1(+D)	1 01E+00	8 16E-01	1 42E+02	4 25E+00
U-238+D		7440-61-1(+D)	7 88E-01	3 13E+00	1 08E+02	1 48E+01

Table 6 Preliminary Risk-Based Remediation Goals for RFETS

**Notes:**

(V) = Chemicals listed are volatile

- = No toxicity value available

NA = PPRG value is not applicable for this exposure scenario Dual oral RfDs available for cadmium The first value (5E-04) is representative of pathways involving water and the second value (1E-03) is representative of pathways involving food (soil)

[a] U.S. Environmental Protection Agency (EPA) 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities Office of Solid Waste and Emergency Response, Washington, D.C. Directive 9355 4-12

[b] The value for residential groundwater ingestion is based on the oral RfD for mercuric chloride since an oral toxicity factor is lacking for elemental mercury

**Appendix O**

**PROCESS DESCRIPTION FOR EVALUATING GROUNDWATER  
IMPACTS TO SURFACE WATER AND ECOLOGICAL  
RESOURCES**

## **APPENDIX O**

### **Process Description for Evaluating Groundwater Impacts to Surface Water and Ecological Resources**

#### **1.0 INTRODUCTION**

The purpose of this appendix is to provide a "process description" to integrate the goals and objectives of groundwater monitoring, hydrogeologic characterization, and remedial actions at RFETS. The intent of this process description is not to prescribe specific analyses that must be performed, but to present a general approach that defines how groundwater contamination at RFETS will be assessed and addressed. By developing an integrated process, it is expected that the basis for decisions regarding the need for remediation and the evaluation of remediation performance will be consistent and will effectively protect surface water and ecological resources. A description of the groundwater plume management and remediation strategy is provided in the IMP Background Document. This appendix encompasses the content of the strategy in the IMP.

In essence, the groundwater contamination assessment and remediation evaluation process consists of the following phases:

- Initial determination of actual or potential groundwater contamination
- Development of a conceptual model based on adequate characterization of the source, nature, and extent of groundwater contamination
- Evaluation of whether contaminated groundwater has or will adversely impact surface water and ecological resources
- Evaluation of alternatives for mitigating groundwater contamination which impacts surface water or ecological resources, and the selection of an appropriate remedial action
- Verification of the appropriateness or effectiveness of the selected remedial action

In the following sections, each of these phases is discussed in more detail.

#### **1.1 INITIAL DETERMINATION OF GROUNDWATER CONTAMINATION**

This phase is intended to determine whether there is a potential contamination problem. During this phase, no attempt will be made to determine the cause of contamination or how the groundwater contamination is distributed. The evaluation of the presence of groundwater contamination, and if the contamination could impact surface water, is the first threshold when determining if further action is required.

Previous groundwater monitoring programs such as the OU RI/RFI and site-wide characterization activities have made an initial determination of the areas where groundwater is

contaminated The IMP provides for continued monitoring to assess changes in these areas of groundwater contamination and to identify new problem areas

## **1.2 CHARACTERIZATION OF THE GROUNDWATER CONTAMINATION AREA (PLUME EVALUATION)**

The primary purpose for characterizing and evaluating the nature and extent of groundwater contamination is to obtain sufficient data to support the development of a conceptual model of the problem area and to support the analyses necessary to evaluate the impact to surface water or ecological resources Characterization may include, but is not limited to

- Defining the extent of groundwater contamination
- Identifying potential source areas and contaminants of concern
- Defining plume extent through determining the linear and areal extents of the pathway through subsurface correlation of standard thickness and permeable lithologies
- Recharge and discharge through quantification of water balance, velocity, gradient, and direction of groundwater flow
- Concentration loadings and mass flux of contaminants to surface water
- Effects due to seasonal variations, natural attenuation of contaminants, or changes in discharge due to construction/removal of containment structures, treatment systems or removal of sources

Decisions with respect to plume evaluations will be made with consultation from the groundwater workgroup during various stages of the process Results of the characterizations will be used to update the ER ranking process under RFCA to ensure that the available budget will be allocated to areas with the highest potential for contamination

### **1.2.1 Evaluation of Existing Data**

Once the available data have been compiled they can be used to develop a conceptual model of the groundwater contamination area As the conceptual model is being formulated, ongoing evaluations will be performed to determine whether the data set is of sufficient quantity and quality to support the conceptual model Some of the questions that should be answered include

- Are the types of data adequate for the conceptual model (e g , hydraulic conductivity, stratigraphic, and geologic, piezometric, water quality analyses for the contaminants of concern)
- Is the quantity of data sufficient (e g , spatial or temporal coverage)
- Is the quality of the data set sufficient to address the program objectives (e g , use of accepted analytical methods, meeting QA/QC objectives)

If a consideration of these questions shows that the available data are inadequate, then additional data should be collected to fill the data gaps

### **1.2.2 Collection of Additional Data**

Prior to collecting any additional data, the DQOs should be defined to provide a clear purpose for collecting the additional characterization data. For example, an objective might be to better delineate groundwater flow direction, or to determine concentration trends within specific wells. Once the DQOs have been defined, then the appropriate sampling program may be developed and implemented. At this stage, the new data are incorporated and the conceptual model refined. The data questions outlined above should be addressed to determine whether the conceptual model is valid.

### **1.2.3 Establishing Baseline Conditions**

The baseline assessment may have either of two purposes. The first purpose is to establish the current level of impacts to surface water or ecological resources. The second purpose may be to establish hydrogeologic conditions at specified locations prior to, during, or immediately after remediation.

In the first instance, the baseline case is used to determine whether changes in upgradient conditions will have an adverse or beneficial impact on downgradient surface water or ecological resources. In addition, the first type of baseline case can factor into the decision whether remediation or continued monitoring is the appropriate course of action to protect surface water or ecological resources. In the second instance, the baseline assessment will be the basis for evaluating how downgradient conditions change in response to upgradient remedial actions.

## **1.3 EVALUATION OF IMPACTS TO SURFACE WATER OR ECOLOGICAL RESOURCES**

Pursuant to the RFCA, "[p]rotection of all surface water uses with respect to fulfillment of the Intermediate and Long-Term Site Conditions will be the basis for making soil and ground water remediation and management decisions." Therefore, it is necessary to evaluate the current and future impacts of groundwater on surface water or ecological resources to ensure that these resources are protected.

The evaluation of impacts to surface water will focus on three areas: the direct discharge of groundwater or seeps to surface water, the impact of groundwater to a specified reach of the stream (surface water and alluvium) downgradient from the point of discharge, and the concentration of contaminants at downstream surface water monitoring locations.

Ecological impact assessments will be based on site-specific conditions. The impact evaluations may either be supported directly by the data, by the use of analytical methods, or, if necessary, through the application of numerical models. The determination of which method of analysis to use will be based on the issues that are to be addressed, the limitations inherent in the data, the accuracy of the desired results, or available resources.

## 1.4 EVALUATION OF ALTERNATIVE REMEDIAL ACTIONS

Upon determination that contaminated groundwater has or may potentially impact surface water or ecological resources, alternative remediation scenarios should be evaluated. Alternative remedial actions include, but are not limited to:

- No action
- Source removal
- Source containment
- Plume containment
- Plume interception

Alternatives will be developed and considered on a site-by-site basis. The evaluation of alternatives will generally consist of the following steps:

- Definition of remediation objectives
- Determination of whether the data and conceptual model will support the analyses necessary to evaluate the different alternatives
- Completion of an alternatives assessment including the evaluation of surface-water or ecological impacts during remedy implementation, and in the future, considering the compatibility with other RFETS closure activities
- Selection of an alternative that is protective of surface water and ecological resources

The results of the alternatives analysis will be presented in a RFCA decision document. In essence, the documentation should summarize:

- The conceptual model describing hydrogeologic conditions
- The analytical tools used to evaluate the data
- The basis for selecting the parameters used for assessing system performance
- The type of impact, if any, to surface water or ecological resources
- How impacts have changed and may change with time
- The assessment of alternatives if remedial action is necessary
- Outline of remedial design/construction and/or monitoring actions as necessary

Development and consideration of alternatives will involve consultation with the groundwater working group during key phases of the process. Within this context, the parties should reach a consensus regarding specific contaminant source areas, groundwater plumes, and the appropriate response. Once an alternative has been selected, a remediation/management project will be developed with its own scope, schedule, and budget.

## **1.5 REMEDIAL DESIGN/CONSTRUCTION**

If a remedial action decision has been reached, additional information may be needed to aid the design and construction of the remedial system. A DQO process, as defined in the IMP, will be employed to establish the decision, and data needs to aid in the construction of the remedial system. The remedial system may consist of a groundwater containment or treatment system, or a source removal action. Components of this step may include:

- Preparation and presentation of design documents and construction workplans
- Preparation and presentation of additional sampling and analysis plans
- Determination of performance monitoring requirements

Development and consideration of alternatives will involve consultation with the groundwater working group during key phases of the project.

## **1.6 VERIFICATION OF THE SELECTED REMEDIAL ACTION**

Once a selected remedial action has been implemented, it may be necessary to demonstrate that the action meets the prescribed remediation goals. To verify the adequacy of a remedial action, the performance criteria must be clearly defined. For example, the performance criteria for a source removal remedy would be quite different than the performance criteria for a plume intercept remedy. The effectiveness of the former could be easily demonstrated by a trend showing a reduction with time of contaminant concentrations in and immediately downgradient of the remediated area, whereas the effectiveness of a plume intercept system might be evaluated relative to water quality criteria at a point of compliance. The performance criteria will need to be defined on a case-by-case basis, accounting for the site- and contaminant-specific characteristics of different plumes. Decisions will require consultation of the groundwater working group during key phases of the evaluation, and performance monitoring will be implemented through the IMP process.

## **APPENDIX P**

### **METHODOLOGY FOR UPDATED ENVIRONMENTAL RESTORATION RANKING**

#### **1.0 FISCAL YEAR 1996 - UPDATE ENVIRONMENTAL RESTORATION RANKING**

This document presents the fiscal year 1996 (FY96) update to the methodology presented in the RFCA Attachment 4, which contains the 1995 prioritized list of ER sites developed to select the top priority sites for remediation (DOE, 1995a). The ER ranking was developed to be used as an aid in planning and prioritizing remedial actions at RFETS. The sequence of remediation activities at RFETS has generally followed the prioritization. Other factors that also influence the remediation sequence are funding, project cost, resource availability, data sufficiency, and integration with other remedial and Site activities. Prioritization accelerates the cleanup process of the worst sites first, and more quickly reduces risks to human health and the environment. The prioritization of cleanup targets also results in cost reductions by allowing better planning, and more efficient utilization of resources.

The 1995 prioritization methodology was developed by a working group of the EPA, CDPHE, DOE, Kaiser-Hill, and RMRS staff and was implemented by RMRS. The result was a prioritized list of ER sites, including a list of ranked sites that require more information (DOE, 1995a). In accordance with RFCA Attachment 4, the ranking has been updated during FY96. The evaluation process is essentially the same as was used in the September 1995 ranking, with the following exceptions:

- ALF for Surface Water, Groundwater, and Soils (RFCA Attachment 5) values were used
- The scoring scale was adjusted to reflect the greater range in ALF ratios
- Impact to surface water was evaluated instead of mobility
- A professional judgment factor was added to account for process knowledge
- Groundwater plumes were evaluated and ranked separately from the contaminant source
- The secondary evaluation, which included project cost and schedule estimates, has been omitted due to other planning activities ongoing at the RFETS

#### **1.1 METHODOLOGY**

The ranking process detailed in RFCA Attachment 4 was slightly modified in 1996 to incorporate the ALF and process knowledge. This ranking was generated by using concentrations of contaminants present at different sites, action levels for the appropriate media and location, and factors for impact to surface water, potential for further release, and professional judgment to develop a score for each site. The scores were then ranked to determine which sites have the highest priority. This methodology is conservative and is used only to generate a list to prioritize remedial actions, and pre-remediation investigations. It is not meant to replace a formal risk assessment.

Ecological risk was also considered during the ranking. The recently completed ecological risk assessment was considered during evaluation of the Buffer Zone. There is no unacceptable ecological risk from Buffer Zone IHSSs under present conditions and exposure pathways. An ecological risk assessment has not been completed for the Industrial Area. Ecological factors were not considered when ranking IHSSs in this area.

The following steps were used in the 1996 ranking process:

- The existing analytical data were compared to background data
- Data exceeding background were compared to the ALF values
- Ratios of Tier II ALF values to contaminant concentrations/activities were used for the ranking, unless Tier II values were not available
- A column was added to the ranking sheet to note Tier I exceedances
- The resulting ratios were converted to a score of 1 to 10
- The impact to surface water was evaluated, and assigned a factor of 1 to 3
- The potential for further release was evaluated, and a factor of 1 to 3 applied
- Process knowledge of the site was evaluated, and a professional judgment factor of 0.5 to 2 applied
- The results of the previous steps were multiplied to generate a score per site, this score was used to rank the ER sites

Analytical data in the SWD from 1990 to the present were evaluated for three media, surface soils, subsurface soils, and groundwater. The analytical data were extracted from the SWD and compiled into data sets by media and analytical suite. The media-specific analytical data were compared to the media- and chemical-specific background mean plus two standard deviations (M2SD). All data above the background M2SD were then compared to the appropriate ALF values in RFCA. The draft radiological ALF values for surface soils (See Appendix L) were applied to both surface and subsurface soils. The ALF values for metals in subsurface soils were not agreed upon in time to be included in the 1996 ranking and metals data from subsurface soils were not used in the ranking. A review of the data suggests that this will not effect the ranking significantly.

All exceedances of the values were tabulated for groundwater, subsurface soils, and surface soils at each sample location. The locations were plotted on maps using available survey information. Where no survey data is available, approximate locations were derived from work plan maps. The sample locations were assigned to areas-of-concern, IHSSs, and groundwater plumes based on the media, location of the exceedance, and the analyte.

#### Media Specific Evaluations

**Groundwater** - Sitewide groundwater data were compared to background M2SD values presented in the 1993 *Background Geochemical Characterization Report* (DOE, 1993a). Groundwater data were then compared to the ALF values. All well locations where a chemical concentration exceeds a ALF value were plotted. The locations were then associated with the

most probable source area and known groundwater plumes Ratios of analyte concentrations to the Tier II ALF values were used in the scoring

**Subsurface Soil** - All available subsurface soil data collected since 1990 were compared to subsurface soil background M2SD values (DOE, 1993a) The data for volatile organic compounds were compared to the ALF values the radiological activities were compared to the surface soil ALF values The ALF values for metals in subsurface soils are in ALF The locations of all borings where a chemical concentration exceeded an ALF value were plotted and associated with the most likely source area

**Surface Soil** - All available surface soil data for metals and radiologicals were compared to M2SD background values computed from data presented in the *Geochemical Characterization of Background Surficial Soils, Background Soils Characterization Program, May 1995* (DOE, 1995c) The inorganic and radiological results above background and all data for organic compounds were compared to the ALF values for surface soil Within the boundaries of the Industrial Area OU, the surface soil data were compared to office worker ALF values In the Buffer Zone OU, the surface soil data were compared to open space ALF values The ALF exceedances were plotted to determine the most likely source area, IHSS or group of IHSSs, using the most common wind patterns Ratios of analyte concentrations to the Tier II ALF values were used in the scoring

#### **Chemical Score Tabulation**

All ALF exceedances were tabulated by IHSS, group of IHSSs, or source area The chemical score was calculated for each media, within each site, by adding the maximum ratio for each analyte per media The groundwater, subsurface soil, and surface soil scores were then summed to generate a total score per site This is a conservative approach that allows the sites to be judged on a uniform basis

A separate score was derived for each groundwater plume by evaluating only the groundwater exceedances A risk score was calculated for each plume, as above, by adding the maximum ALF ratios for groundwater contaminants associated with all sites within the estimated plume area This method results in groundwater being used twice, once in the scoring of sources, and again for the scoring of groundwater plumes The total chemical scores were graded according to the following table so that the risk component of the ranking system would be weighted similarly to the other components This table has been adjusted from the 1995 methodology due to the increase in the range of the scores

Total Chemical Score	ALF Score
>20001	10
10001-20000	9
5001-10000	8
1001-5000	7
501-1000	6
251-500	5
126-250	4
75-125	3
26-75	2
1-25	1

#### **Surface Water Impacts**

The impact of contamination at a site on surface water quality was evaluated and each site was assigned a factor of 1 to 3 to indicate the impact on surface water from each site. The impact to surface water factors were assigned on a scale of 1 to 3 as follows:

1. Contaminants that are immobile in the environment or for which there is no pathway to surface water. Radionuclides and metals were given a score of one unless adjacent to surface water, or on a steep slope bordering surface water. This rating was used where engineered structures are in place that prevent the spread of contaminants.
2. This rating was applied where contaminants have or are expected to have an impact on surface water at the Tier II ALF level (MCL).
3. This rating will apply where there is a documented or probable impact to surface water above the Tier I ALF value (100 x MCL).

#### **Potential for Further Release**

This factor takes into account the potential for additional release of contaminants into the environment and includes cross-media movement of contaminants within the environment. Sites were assigned a value of 1 to 3 based on the following criteria:

1. Assigned to a location when contamination were not present as free product, very high concentrations, and/or show no cross contamination of environmental media.
2. Any location where free product may be present in the ground and/or where there is a potential for cross contamination.

- 3 Locations where there is indication or certainty that free product exists in the ground, where significant levels of contamination exist, and/or where cross contamination of environmental media is present

#### **Professional Judgment**

A professional judgment factor was added to the FY97's ranking based on process knowledge not represented by the other factors. The reasons for assigning the professional judgment factor are given in the comment column of the ranking. The values for this factor are

- 0 5 The ranking overestimates the priority of a site. This was used if a risk assessment or conservative screen has been completed indicating an acceptable risk, but the site ranks high on the priority listing
- 1 The ranking reflects process knowledge of a site
- 2 The ranking underestimates the priority of a site. This may be due to a lack of data, coupled with process knowledge of significant releases

#### **Total Score and Ranking**

The total score was calculated by multiplying the ALF score times the impact to surface water, potential for further release, and professional judgment factors. A formal risk assessment is a more precise evaluation of the same data, and, where risk assessment data exist, they were used to refine the ranking of the sites through the use of the professional judgment factor.

Where insufficient data currently exist to rank sites, these sites were assigned to the category of needs further investigation (INV) and ranked using the professional judgment factor. This placed them on the ranking above known low-risk sites. As data become available, the ranking for these sites will be updated.

The Solar Ponds groundwater score was calculated without using data from an upgradient well which shows the effects of an upgradient plume. Instead, this well was used in the calculations for the groundwater score for IHSS 118 1 and the carbon tetrachloride spill plume.

Where analytical data and process knowledge indicate that there are localized areas of contamination, the associated data were eliminated from site evaluation, and assigned to a hot spot list. These sites will be evaluated to verify that these are hot spots. Most of the localized extent sites are PCB sites, including a PCB site in IHSS 150 6 and those surrounding Bowman's Pond. The Old Landfill has analytical data indicating the presence of small radiological anomalies at the surface. Best management practices will be used on these hot spots as part of the final remedy for the Original Landfill.

Radium 226 and 228 data were not evaluated for the following reasons

- Radium 226 and 228 are not listed as having been used at RFETS in either the *Historical Release Report* (DOE, 1992a) or the *Project Task 3/4 Report Reconstruction of Historical Rocky Flats Operations and Identification of Release Points* (ChemRisk, 1992)
- The decay chains and half-lives of decay products make it highly unlikely that significant amounts of radium 226 or 228 would have accumulated by radioactive decay of radionuclides known to have been used at RFETS
- The soils and groundwater in the foothills to the west of RFETS are known to have high levels of both uranium (total) and radium 226
- The background amount for radium 226 in surface soil has a PPRG ratio of 48. Therefore, any surface soil analytical result above background would skew the prioritization score to a higher result. This is not justified given the information on usage and natural occurrence.

## **APPENDIX Q**

### **1.0 EXAMPLE OF HISTORICAL RELEASE REPORT UPDATE**

#### **PAC REFERENCE NUMBER: NW-195**

IHSS Reference Number      195, Operable Unit 16  
Unit Name                      Nickel Carbonyl Disposal  
Approximate Location        N754,500, E2,083,000

#### **Date(s) of Operation or Occurrence**

March through August 1972

#### **Description of Operation or Occurrence**

From March through August 1972, cylinders of nickel carbonyl were disposed in a dry well located in the buffer zone. The cylinders were opened inside the well and vented with small arms fire to allow decomposition in air (DOE 1994b).

#### **Physical/Chemical Description of Constituents Released**

Nickel carbonyl vapors are denser than air. Consequently, the vapors collected and decomposed in the bottom of the well. Because these vapors ignite spontaneously, ignition occurred either immediately after release into the well or sometime after collection at the bottom of the well (DOE 1992a, 1992b).

#### **Response to Operation or Occurrence**

After 24 hours of placement in the well, the cylinders were removed from the hole, vented by small arms fire, and buried in the Present Landfill. Two cylinders became stuck in the hole and were buried in place. A minimal amount of nickel carbonyl was probably released to the atmosphere during disposal. Samples (presumably of air) from the lip of the well taken after the initial disposal indicated nickel carbonyl concentrations of approximately 10 parts per million being released during disposal (DOE 1992a, 1992b). This IHSS was then studied in accordance with the IAG as part of OU 16 (DOE 1992b).

#### **Fate of Constituents Released to the Environment**

Nickel carbonyl is highly volatile and readily decomposes in the presence of oxygen, forming nickel oxide. Nickel oxide is highly insoluble in groundwater. For every gram (0.002 pound) of

nickel oxide in contact with typical groundwater, approximately 10–26 microgram of nickel per liter is transferred to solution. Wind dispersion subsequently disseminated the nickel oxide particles, which therefore would not be detected at concentrations exceeding background. IHSS 195 does not pose a risk to human health and the environment because there are no viable transport pathways.

**Action/No Action Recommendation**

Based on information presented in the *Final No Further Action Justification Document for Operable Unit 16, Low-Priority Sites* (DOE 1992b), a CAD/ROD recommending no action under CERCLA for IHSS 195 was prepared, and received final approval on October 28, 1994 (see attached declaration).

**Comments**

None

## APPENDIX R

### 1.0 ADMINISTRATIVE RECORD DOCUMENT IDENTIFICATION

In assessing the relevance of a document to the AR, there are two basic questions 1) could the document be used or relied upon in deciding how to clean up an IHSS, and 2) will the document be used to inform or involve the public in the clean up of IHSSs at Rocky Flats? A document does not need to be specific to an IHSS to be considered for its remediation. An example would be a document outlining procedures for protecting endangered species at Rocky Flats. While this does not address itself to any particular IHSS, all proposals for remediation would have to take the endangered species procedure into consideration.

Below are some specific documents types that would be included in the AR. Documents generally excluded from the AR are listed in the Level 1 procedure, 1-F78-ER-ARP 001, CERCLA *Administrative Record Program* (RMRS, 1994b).

In accordance with 40 CFR § 300.810, the AR for the selection of a response action may contain the following types of documents:

- 1 Documents containing factual information and data, and analysis of the factual information and data that form a basis for the selection of a response action, such as the following:
  - CEARP reports
  - RI/FS Work Plan
  - Amendments to the Final Work Plan
  - SAP (consisting of a QAPjP and a FSP)
  - - Validated and verified sampling and analysis data
  - Chain of Custody forms
  - Site inspection and evaluation reports
  - Data summary sheets
  - Technical and engineering evaluation performed for the site
  - IHSS-specific HSPs
  - Documents supporting the LRA's determination of imminent and substantial endangerment assessment
  - Documentation of applicable of relevant and appropriate requirements
  - RI/FS Report

- RFI/RI
- RFI/RI TMs
- Data submitted by the public (including potentially responsible parties)

2 Documents received, published, or made available to the public for remedial actions or removal plans, such as

- RFSIPIP
- PP
- Public notices of AR availability and public comment periods
- Documentation of public hearings
- Public comments
- Transcripts of public meetings
- Response to significant comments
- Responses to comments from state or federal agencies

3 Other information, such as

- AR File Index
- Documentation of State involvement
- Health assessments
- Natural Resource Trustee notices and responses, findings of fact, final reports and natural resource damage assessments
- Decision documents rising from dispute resolutions

4 Decision Documents, such as

- IM/IRA
- RODs (including responsiveness summary)
- Explanations of significant differences
- Amended RODs and underlying information

5 For CERCLA sites with a history of RCRA activity, any relevant RCRA information that may be considered or relied on in selecting the CERCLA response action